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INFORMATION SUMMARY, AREA OF CONCERN: GRAND CALUMET RIVER, INDIANA

by

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The Water Quality Act of 1987, Section 118, authorizes the Great Lakes National Program Office (GLNPO) to carry out a 5-year study and demonstration project, Assessment and Remediation of Contaminated Sediment (ARCS), with emphasis on the removal of toxic pollutants from bottom sediments. Information from the ARCS program is to be used to guide the development of Remedial Action Plans (RAPs) for 42 identified Great Lakes Areas of Concern (AOCs) as well as Lake-wide Management Plans. The AOCs are areas where serious impairment of beneficial uses of water or biota (drinking, swimming, fishing, navigation, etc.) is known to exist, or where environmental quality criteria are exceeded to the point that such impairment is likely. Priority consideration was given to the following AOCs: Saginaw Bay, Michigan; Sheboygan Harbor, Wisconsin; Grand Calumet River, Indiana; Ashtabula River, Ohio; and Buffalo River, New York.

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The Environmental Laboratory of the US Army Engineer Waterways Experiment Station (WES) was asked to review existing data and information for each of the five priority AOCs. The approach used by WES was to bring together WES scientists who have been conducting research on the various aspects of contaminant mobility in the aquatic environment and develop a list of information required to evaluate the potential for contaminant mobility. A team of WES scientists then visited the RAP coordinator and associated staff for each AOC. Corps Districts responsible for the navigation projects in each AOC were also visited.

This report summarizes the information obtained for the Grand Calumet River. It is arranged for information retrieval by subject in a quick and easy manner (GLNPO Subject-Reference Matrix). Data and information from numerous reports have been included as figures and tables; wherever possible, the reference sources are identified.

14. (Concluded).

Fish tissue concentrations
Groundwater
Land use
Metal contamination
Pesticides
Point and nonpoint source discharges
Risk assessment
Spills
Toxicity bioassay
Water quality

SUMMARY

The Water Quality Act of 1987, Section 118, authorizes the Great Lakes National Program Office (GLNPO) to carry out a 5-year study and demonstration project, Assessment and Remediation of Contaminated Sediment (ARCS), with emphasis on the removal of toxic pollutants from bottom sediments. Information from the ARCS program is to be used to guide the development of Remedial Action Plans (RAPs) for 42 identified Great Lakes Areas of Concern (AOC) as well as Lake-wide Management Plans. The AOCs are areas where serious impairment of beneficial uses of water or biota (drinking, swimming, fishing, navigation, etc.) is known to exist, or where environmental quality criteria are exceeded to the point that such impairment is likely. Priority consideration was given to the following five AOCs: Saginaw Bay, Michigan; Sheboygan Harbor, Wisconsin; Grand Calumet River, Indiana; Ashtabula River, Ohio; and Buffalo River, New York.

The ARCS Program is to be completed during the period 1988-1992. The overall objectives of the ARCS program are to:

a. Assess the nature and extent of bottom sediment contamination at selected Great Lakes AOC.

b. Evaluate and demonstrate remedial options, including removal, immobilization, and advanced treatment technologies, as well as "no-action" alternatives.

c. Provide guidance on assessment and remedial action to the various levels of government in the United States and Canada in the implementation of RAPs for the areas of concern, as well as direction for future evaluations in other areas.

The Environmental Laboratory (EL) of the US Army Engineer Waterways Experiment Station (WES) was asked to review existing data and information for each of the five priority AOCs. The approach used by WES was to bring together WES scientists who have been conducting research on the various aspects of contaminant mobility in the aquatic environment and develop a list of information (Table 1) required to evaluate the potential for contaminant mobility. All contaminant migration pathways were considered and are shown in Figure 1. A team of WES scientists then visited the RAP coordinator and associated staff for each AOC. Corps Districts responsible for the navigation projects in each AOC were also visited. During these meetings, discussions centered around what information was available for each item on the list of information developed by WES. Sources of additional information were obtained from the discussions.

This report summarizes the information obtained for the Grand Calumet River Area of Concern. The report attempts to retrieve information by subject in a quick and easy manner (GLNPO Subject-Reference Matrix). Data and information from numerous reports have been included as figures and tables. Wherever possible, references are given for the included data and information.

PREFACE

The study reported herein was conducted by the US Army Engineer Waterways Experiment Station (WES) for the US Environmental Protection Agency (USEPA) Great Lakes National Program Office (GLNPO). The work was monitored by the US Army Engineer Division, North Central.

The report was prepared by Dr. J. W. Simmers, Research Biologist, Dr. C. R. Lee, Soil Scientist, Mr. D. L. Brandon, Statistician, Dr. H. E. Tatem, Aquatic Biologist, and Mr. J. G. Skogerboe, Physical Scientist, all of the Contaminant Mobility and Regulatory Criteria Group (CMRCG), Ecosystems Research and Simulation Division (ERSD), Environmental Laboratory (EL), WES.

Generous cooperation and assistance in locating existing data and information were provided by Messrs. Jan Miller and John Dorkin of the US Army Engineer District, Chicago, and Messrs. John Winter and Brad Rutledge of the State of Indiana Department of Environmental Management. Mr. Winter was also the Coordinator of the Remedial Action Plan. Mr. Larry Bird, ERSD, provided technical assistance in the preparation of tabulated data and the manuscript for publication.

The work was conducted under the supervision of Dr. L. H. Saunders, Chief, CMRCG; Mr. D. L. Robey, Chief, ERSD; and Dr. John Harrison, Chief, EL. General supervision was provided by Mr. D. Cowgill, NCD, and Mr. T. Kizlauskas, USEPA GLNPO, initially, and later by Mr. J. Miller, NCD, and Mr. D. Cowgill, USEPA GLNPO.

Commander and Director of WES was COL Larry B. Fulton, EN. Technical Director was Dr. Robert W. Whalin.

This report should be cited as follows:

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CONVERSION FACTORS, NON-SI TO SI (METRIC) UNITS OF MEASUREMENT

Non-SI units of measurement used in this report can be converted to SI (metric) units as follows:

Multiply	By	To Obtain
acres	4,046.873	square meters
cubic yards	0.7645549	cubic meters
inches	2.54	centimeters
miles (US statute)	1.609347	kilometers
pounds (mass)	0.4535924	kilograms
square miles	2.589998	square kilometers
tons (2,000 pounds, mass)	907.1847	kilograms

INFORMATION SUMMARY AREA OF CONCERN: GRAND CALUMET RIVER, INDIANA

INTRODUCTION

Background

The Water Quality Act of 1987, Section 118, authorizes the Great Lakes National Program Office (GLNPO) to carry out a 5-year study and demonstration project, Assessment and Remediation of Contaminated Sediment (ARCS), with emphasis on the removal of toxic pollutants from bottom sediments. Information from the ARCS program is to be used to guide the development of Remedial Action Plans (RAPs) for 42 identified Great Lakes Areas of Concern (AOC) as well as Lake-wide Management Plans (Figure 2).

The AOCs are areas where serious impairment of beneficial uses of water or biota (drinking, swimming, fishing, navigation, etc.) is known to exist, or where environmental quality criteria are exceeded to the point that such impairment is likely. Priority consideration was given to the following five AOCS: Saginaw Bay, Michigan; Sheboygan Harbor, Wisconsin; Grand Calumet River, Indiana; Ashtabula River, Ohio; and Buffalo River, New York.

Each state has established RAP coordinators to develop a RAP for each AOC. Most RAP coordinators state that there is a need to develop guidance to interpret the information in a manner that will allow decisions to be made about each AOC. The following summarizes the status of the RAP Reports for the five priority AOCs:

Area of Concern	Status
Saginaw Bay	Final RAP - September 1988
Grand Calumet River	Draft RAP - January 1988
Sheboygan Harbor	Draft RAP - December 1988
Buffalo River	Final RAP - November 1989
Ashtabula River	Draft RAP - September 1989

Purpose

The purpose of this report is to summarize the information collected during meetings with RAP Coordinators and Corps Districts to find out what information was available on contaminant migration at each of the five priority AOCs.

Scope

Information collected during visits to RAP Coordinators and Corps Districts is summarized. Sources of additional information have been referenced so that these sources could be contacted at a later date. Documents that were mentioned during meetings with RAP coordinators, but were not available at that time, are referenced so that these documents can be obtained, if desired. Retrieval of information by subject in a quick and easy manner was a goal of this report.

Abbreviations

Definitions of abbreviations used in this report are given below.

USEPA	US Environmental Protection Agency
USEPA V	US Environmental Protection Agency, Region V
USACOE	US Army Corps of Engineers
USGS	US Geological Survey
GCR	Grand Calumet River
IHC	Indiana Harbor Canal
GCR-IHC	Grand Calumet River-Indiana Harbor Canal
AOC	Area of Concern
IDEM	Indiana Department of Environmental Management
GLNPO	Great Lakes National Program Office
POTW	Public Owned Treatment Works
RAP	Remedial Action Plan
ISBH	Indiana State Board of Health
IJC	International Joint Commission on the Great Lakes
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
NPDES	National Pollution Discharge Elimination System
PCB	Polychlorinated biphenyl
PAH	Polycyclic aromatic hydrocarbon
USFDA	US Food and Drug Administration
MSD	Metropolitan Sanitary District (Chicago)

SUMMARY OF INFORMATION

Boundary of AOC

The general location of the Grand Calumet River (GCR) AOC is shown in Figure 3, and the boundary is shown in Figure 4. The AOC includes most of the

Grand Calumet River (GCR), the Indiana Harbor and Canal (IHC), and nearshore Lake Michigan. The AOC is located in Lake County, Indiana. The drainage basin composing the Grand Calumet-Indiana Harbor Canal (GCR-IHC) AOC includes approximately 43,000 acres (67 square miles).*

Contaminants of concern

At least 33 studies have been conducted which monitored water, sediment, or biota in the nearshore Lake Michigan portion of the Grand Calumet AOC (Table 2); 10 studies have been concerned with only the GCR-IHC sediments (Table 3). Data from these studies have been collected, and the Contaminants of Concern have been tabulated according to water sediment or biota in the AOC. Contaminants in the GCR-IHC AOC include a mix of metals and organic compounds including PCBs, PAHs, phenol, and cyanide. Fish consumption advisories for Lake Michigan have been promulgated by the states of Indiana, Illinois, Michigan, and Wisconsin as well as the USEPA Great Lakes National Program Office and the USFDA. The 1987 Lake Michigan Advisory suggested the following for Indiana Waters:

> Brown trout over 23 inches, lake trout over 23 inches, Chinook over 32 inches, catfish and carp should not be eaten. Chinook salmon over 21 to 32 inches, lake trout between 20 to 23 inches, Coho salmon over 26 inches, and brown trout up to 23 inches should not be eaten by children age 15 or under, pregnant women, women who may become pregnant, or nursing mothers. All others should limit their consumption to one meal (0.23 kg) per week.

A fish consumption advisory was issued in 1985 which included the GCR/IHC system. No fish from these waters should be eaten.

Other impairments have been beach closings due to high coliform counts, aesthetic impact of crude oil on nearshore beaches, and the poor quality of biological habitats.

Levels of contaminants

The highest concentrations of contaminants found in the Grand Calumet River AOC sediments are listed in Table 4. Ranges of water quality parameters are shown in Table 5.

Volume of contaminated sediments

The Draft IDEM RAP (R15)** has summarized the estimates of the volume of soft, contaminated bottom sediments obtained by the USACOE and USEPA V. These

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* A table of factors for converting non-SI units of measurement to SI (metric) units is presented on page 11.

** See References list at the conclusion of the main text.

estimates are 1.4 million cu yd in the east branch of the Grand Calumet, and 700,000 cu yd in the west branch and IHC upstream of the navigation project. The authorized navigation project contains 1,000,000 cu yd, and the Chicago District USACOE has estimated between 500,000 and 1 million cu yd of soft sediments adjacent to the authorized channel. Altogether, there are approximately 3.5 to 4 million cu yd of contaminated sediments within the AOC.

Sediment data

There have been at least 10 major sediment sampling studies on the GCR/IHC conducted by the USEPA V, the IDEM, and the USACOE. These studies have often included elutriate tests, modeling, and evaluations related to dredged material and disposal. The specific locations of the sampling sites and representative sediment contaminant data are shown in Figures 5-15 and Tables 6-28.

Water quality data

The IDEM, USACOE, MSD, and USEPA V have collected water quality data from the GCR-IHC and nearshore Lake Michigan. The IDEM has maintained a fixed station water quality surveillance program for several years in conjunction with the activities to monitor industrial and municipal wastewater discharges. Collection locations and typical data from the water quality assessments, including groundwater, are shown in Figures 16-26 and Tables 29-35.

Point source discharges

The Grand Calumet is predominantly fed by municipal and industrial waste water (up to 90 percent of the flow). The NPDES permits and extensive monitoring of outflows have produced an extensive body of data. Representative water quality monitoring data from industrial and municipal point sources, and the results and locations of monitoring stations and inflows are provided in Figures 27-30 and Tables 36-45. Improvement in POTW by municipal treatment facilities is shown in Table 46.

Nonpoint source discharges

Studies have been performed by the USEPA on the combined sewer overflow (CSO) loadings to the CG/IHC. In addition, as part of the analysis for a draft EIS on maintenance dredging and disposal, the Chicago District USACOE estimated the annual loadings of sediments to the GCR/IHC from point and nonpoint sources. These data are shown in Tables 47-49. The IDEM data have indicated that groundwater in the AOC is contaminated (Figure 25).

Waterway hydraulics/watershed hydrology

The drainage basin of the Grand Calumet is shown in Figure 31. Stream flow directions are shown in Figure 32. Flow data for IHC and the Grand Calumet River are summarized in Tables 50-54 and Figures 20 and 31-33. The sites evaluated in the USGS inflow investigation, as shown on USGS topographic sheets, are illustrated in Figure 34.

Air quality

Air quality data have been collected by IDEM. The air quality of Lake County was monitored for suspended particulates, sulfur dioxide, volatile organic compounds, nitrogen oxides, and carbon monoxide. The sources of the contaminants and percentage originating at each source have been identified. These data are summarized in Figures 35-37.

Potential hazardous
waste sites/Superfund sites

Fifty sites have been identified and listed (Table 55), which are a mixture of NPL, RCRA, and CERCLA. There are 38 waste fills or lagoons in the AOC (Table 56). Of these sites, 11 have been considered to have highest priority (Table 57). The site locations of major landfills and national priority list sites are shown in Figure 38.

Spills

The IDEM has documented the spills that have occurred in Lake County and in the vicinity of the AOC. In 1986 there were 60 spills in Lake County. Locations and sources of spills are presented in Figures 39-42.

Adjacent land use contaminant sources

Adjacent land uses are predominantly industrial in nature. This has been extensively documented by the IDEM, USACOE, USGS, and USEPA. The adjacent land uses have previously been indicated in Tables 36-45 and Figures 20, 27-30, 34, and 40 in relation to point and nonpoint source discharges. Additional information on adjacent land use is shown in Figures 43-45 and Tables 55-57. There are 180 hazardous waste facilities in Lake County. A small portion of the land is still devoted to parks and natural areas (Figure 46).

Bioassay data

The contaminant mobility from sediment in the GCR/IHC area has been the subject of numerous bioassays or bioassessments. Many of the bioassays were conducted to evaluate the suitability of the sediment in the Federally authorized channel for various disposal alternatives. Other series of bioassays were conducted to evaluate the toxic and chronic effects of municipal and industrial outfalls. Only biological assessments conducted with laboratory organisms under controlled conditions will be tabulated under this topic heading; field-oriented studies appear under "Biological Data." Typical Extraction Procedure-toxicity test results are shown in Table 58. Embryo-larval teratogenicity-toxicity test results on outfall effluents are shown in Tables 59 and 60. Predictions of total bioaccumulation potential based on animal lipid concentrations and sediment TOC are shown in Table 61. The results of bioassay procedures applied to evaluate the suitability of sediments from the Federal channel for upland disposal are shown in Tables 62-66.

Biological data

The natural areas that occur within the GCR-IHC AOC are illustrated in Figure 47. The dune and swale ecosystems identified and inventoried by the Lake Michigan Federation and the Coastal Zone Management Program are relatively unique remnants of once extensive dune areas.

Field biological assessments have taken two forms: assessments of the presence of fish and wildlife (including endangered species), and collection of organisms for chemical analysis or other evaluations related to the presence of contaminants. Electrofishing, crayfish trapping, plankton/periphyton collection, and protozoan colonization and photosynthetic/respiration response tests were conducted on in-place sediments. The results are presented in Tables 67-77 and Figures 47-49. Aquatic (including benthic) macroinvertebrates were also collected. Biomass, diversity, and population density are shown in Tables 78-81. Lists of aquatic species present are provided as Tables 82-85. Fishery advisories are in effect throughout the AOC, as previously noted. In the GCR-IHC, the advisories pertain to recreational fishing, since there has never been a fishery of commercial proportions.

Typical wildlife (exclusive of avifauna) are listed in Table 86; dominant vegetation components are listed in Table 87. The dense cattail marshes bordering portions of the GCR-IHC may be important as wildlife cover. The remnants of the dune and swale ecosystem in the GCR-IHC are the locations of unique plant and animal communities. Rare animals include the glass lizard, Franklin's ground squirrel, Blanding's turtle, and the Federally endangered Indiana bat. Five plant species characteristic of the dune and swale areas are candidates for Federal endangered listings. Bird life of the AOC includes numerous State threatened and endangered species, including the black tern and the American bittern.

Risk assessment

There are no risk assessment data other than the fish consumption advisory and the beach closings previously mentioned. The risk to the human population is implied by the water quality data summarized in Table 5 and the percentage of the monitoring stations where water quality standards were exceeded (Table 33).

GLPNO SUBJECT-REFERENCE MATRIX

AREA OF CONCERN: Grand Calumet River, Indiana

Subject	Reference*	Point of Contact**
Sediment		
Metals	R1, R2, R3, R5, R7, R9, R10, R13, R15, R19, R20, R24, R25, R32, R34, R36, R41	P2, P3, P7, P9, P10, P12
PCBs	R1, R2, R3, R4, R5, R7, R10, R13, R15, R17, R19, R20, R23, R24, R25, R32, R33, R34, R36, R41	P2, P9, P7, P10, P12, P3
PAHs	R1, R3, R13, R15, R19, R20, R24, R24, R25, R32, R34, R41	P2, P3, P7, P9, P10, P12
Pesticides	R7, R13, R23, R24, R25, P36, R41	P2, P3, P7, P9, P10, P12
TOC	R1, R5, R13, R15, R24, R25, R34	P2, P7, P10, P12
Others (specify)		
Phenols	R1, R10, R15, R20, R24, R25, R41	P2, P7, P9, P10, P12
Ammonia	R1, R10, R18, R24, R25, R41	P2, P7, P10, P12
Cyanide	R1, R10, R41	P2, P7, P9, P10, P12
Total inorganic carbon	R34	P2, P7, P10, P12
Total solids	R2, R3, R5, R10, R18, R25, R34, R41	P2, P7, P10, P12
Total volatile solids	R5, R10, R15, R18, R41	P2, P6, P7, P10, P12
O&G	R2, R5, R10, R15, R18, R24, R32, R34, R41	P2, P7, P9, P10, P12
Halogenated hydrocarbons	R34	P2, P7, P6, P9, P10, P12
COD	R3, R10, R15, R18, R41	P2, P7, P10, P12
BOD	R3, R15, R18	P2, P7, P10, P12
TKN (nitrogen)	R10, R15, R18, R34, R41	P2, P7, P10, P12
Phosphorus	R15, R18, R24, R25, R34, R41	P2, P7, P10, P12
pH	R25	P2, P7, P10, P12
Conductivity	R25	P2, P7, P10, P12
CEC	R25	P7, P10
Modified elutriate	R24, R25, R41	P2, P12
DTPA extraction	R24, R25, R41	

(Continued)

* Numbers refer to sources listed in the References section.
** Points of contact are listed on page 28.

GLNPO SUBJECT-REFERENCE MATRIX (Continued)

Subject	Reference	Point of Contact
Peroxide oxidation	R24, R25	
EP-Toxicity	R41	P2
Particle Size	R5, R10, R15, R18, R24, R25, R41	P2, P12
Engineering properties	R15, R24, R25, R41	P2, P6
Deposition data	R15, R18, R35, R38	P2, P6, P7, P10
Transport data	R15, R18, R35, R38	P2, P6, P7, P10
Depth data	R5, R10, R15, R18, R35, R41	P2, P6, P7, P10, P12
Horizontal distribution	R15, R35, R41	P2, P6
Volume to be considered	R4, R15, R24, R25, R34, R35	P2, P6, P12
Water quality	R8, R14, R15, R22, R24, R25, R41	P7, P10, P12
Physical data	R8, R11, R12, R16, R18, R22, R23, R37	P7, P10, P12
Temperature	R12, R13, R18, R22, R23, R37	P7, P10, P12
DO	R11, R12, R15, R16, R17, R18, R22 R23, R37, R41	P7, P10, P12
Conductivity	R12, R18, R22, R23, R26, R37	P7, P10, P12
Hardness	R8, R12, R22, R37	P12
Total solids	R8, R12, R13, R15, R18, R22, R37, R41	P12
Suspended solids	R8, R12, R13, R18, R22, R25, R37, R41	P12
Chemical data		
PH	R11, R12, R13, R15, R16, R18, R22, R23, R25, R37	P7, P10, P12
TOC	R8, R11, R13, R16, R22, R25	P7, P10, P12
Metals	R8, R11, R12, R13, R15, R16, R17 R18, R20, R22, R23, R25, R41	P3, P7, P10, P12
PCBs	R8, R11, R13, R15, R16, R17, R20, R23, R25, R41	P3, P7, P10, P12
PAHs	R8, R11, R13, R16, R20, R25, R26, R41	P3, P7, P10, P12
Pesticides	R8, R11, R16, R23, R25	P3, P7, P10, P12
BOD	R11, R12, R16, R17, R18, R22, R41	P7, P10, P12
Others (specify)		
Phenols	R8, R11, R12, R13, R15, R16, R17, R18, R20, R22, R23, R25, R41	P7, P10, P12

(Continued)

GLNPO SUBJECT-REFERENCE MATRIX (Continued)

Subject	Reference	Point of Contact
Ammonia	R8, R11, R13, R15, R16, R17, R18, R22, R23, R25, R37, R41	P7, P10, P12
Chlorides	R11, R12, R13, R15, R16, R17, R18, R22, R23	P7, P10, P12
Fluorides	R12, R13, R15, R18, R22	P7, P10, P12
Sulfates	R12, R13, R15, R18, R22, R23, R26	P7, P10, P12
Nutrients	R8, R12, R13, R15, R18, R22, R23, R37	P7, P10, P12
Cyanide	R8, R12, R13, R15, R17, R18, R22, R23, R41	P7, P10, P12
O&G	R8, R17, R18, R22, R41	P7, P10, P12
Bacteria	R8, R11, R13, R14, R15, R16, R17, R18, R22, R41	P7, P10, P12
Waterway hydraulics		
Flow data	R1, R11, R12, R14, R15, R16, R18, R20, R27, R37, R38	
Water depth	R10, R12, R15, R18, R37	
Flood data	R18, R37	
Point discharges	R11, R13, R14, R15, R16, R17, R18, R20, R21, R41	
Concentration data	R11, R13, R14, R15, R16, R18, R20, R21	
Volume data	R11, R12, R13, R14, R15, R16, R18, R20, R21, R41	
Waste load data	R11, R12, R13, R14, R15, R16, R18, R20, R21, R41	
Nonpoint discharges	R11, R12, R13, R14, R15, R16	
Concentration data	R11, R12, R13, R16	
Volume data	R11, R12, R13, R16	
Waste load data	R11, R12, R13, R16	
Spills	R11, R13, R14, R16	
Watershed hydrology	R11, R14, R15, R16, R18, R27, R28, R37	
Rainfall data	R37, R41	
Acid rain		

(Continued)

GLNPO SUBJECT-REFERENCE MATRIX (Continued)

Subject	Reference	Point of Contact
Runoff data	R11, R14, R15, R16, R24, R41	
Volume		
Solids	R24, R25, R41	
Chemical data (specify)	R24, R25, R41	
Groundwater	R11, R14, R15, R16, R24, R25, R27, R28, R37	
Chemical data		
pH	R28, R37	
Conductance	R28, R37	
Metals	R28, R37	
Organics	R28, R37	
Phenol	R28, R37	
Air		
Air quality data	R13, R14, R15	P5, P6
Atmospheric deposition	R13, R14, R15	P5, P6
Superfund sites	R11, R13, R14, R16	
Adjacent land use	R1, R11, R13, R14, R15, R16, R17, R18, R32	P12
Contaminant sources	R1, R11, R13, R14, R15, R16, R18	P12
Risk assessment	R11, R13, R14, R16, R19	
Bioassay data		
Acute	R7, R13, R15, R19, R24, R26, R29, R41	P3, P11, P12
Chronic	R13, R26, R29, R30, R41	P3, P11, P12, P13
Bioaccumulation	R13, R24	P3, P11, P12
Other		
Protozoan community bioassay	R1	P11
Microtox	R1	P11
Algal photosynthetic inhibition	R1	P11

(Continued)

GLNPO SUBJECT-REFERENCE MATRIX (Continued)

Subject	Reference	Point of Contact *
Nematode growth and development	R1	P11
Membrane dialysis bags	R1	P11
Earthworms	R24	
Higher plants	R24	
Teratogenic effects	R26, R30, R41	P13
Phototoxicity and photo-mutagenicity	R29	P8
Biological data		
Fish		
Diversity	R1, R11, R13, R14, R15, R16 [illegible], R19, R22, R35, R38, R39, R41	P1, P7, P10, P11, P12
Quantity	R1, R11, R13, R1[illegible], R15, R16, R17, R19, R22, R35, R38, R39, R41	P7, P10, P11
Tissue content	R1, R11, R13, R14, R15, R16, R19, R20, R22, R24, R25, R41	P1, P3, P7, P10, P11, P12
Advisory	R11, R13, R14, R15, R16, R22	P11
Benthic		
Diversity	R1, R11, R13, R14, R15, R16, R18, R19, R31, R35, R38, R39, R41	P7, P10, P11
Abundance	R1, R11, R13, R14, R15, R16, R18, R19, R31, R35, R38, R39, R41	P7, P10, P11
Content	R1, R20, R24, R25	P11, P12
Reptiles/ amphibians	R17, R38, R39	
Birds		
Diversity	R15, R17, R38, R39, R41	
Quantity	R15, R17, R38, R41	
Contents		
Plants (incl. algae)		
Diversity	R1, R15, R17, R18, R38, R39, R41	P4
Abundance	R1, R15, R17, R18, R38, R39, R41	P4
Contents	R24	
Mammals	R15, R17, R18, R38, R41	

(Continued)

GLNPO SUBJECT-REFERENCE MATRIX (Concluded)

Subject	Reference	Point of Contact
Endangered species	R15, R17, R40, R41	P4
Other		
Plankton	R1, R15, R18, R22	P11

REFERENCES

R1 Risatti, J. Bruno, and Ross, Philippe, Eds. 1989. Chemical, Biological and Toxicological Study of Sediments from Indiana Harbor and Canal and Adjacent Lake Michigan, (Preliminary Report to Chicago District, US Army Corps of Engineers, Chicago, IL.).

R2 Resources Conservation Company. 1988. B.E.S.T. Glassware Test Report for US Army Corps of Engineers Indiana Harbor. Resources Conservation Company, Belleview, WA.

R3 Lehman, Richard W. 1988. Wet Air Oxidation Testing of Indiana Harbor Sludge for US Army Corps of Engineers. Zimpro Passavant Inc., Military Road, Rothschild, WI.

R4 Chicago District, US Army Corps of Engineers. 1988 (3 Oct). Indiana Harbor Navigation Maintenance Draft Plan of Study, CENCC-DD (PM). Chicago, IL.

R5 Polls, Irwin. 1988. Sediment Survey of the Indiana Harbor Canal, Indiana Harbor, and Adjacent Lake Michigan for the Chicago District, US Army Corps of Engineers. The Metropolitan Sanitary District of Greater Chicago.

R6 Environmental Laboratory. 1986. Disposal Alternatives for PCB-Contaminated Sediments from Indiana Harbor, Indiana; Vol I. US Army Engineer Waterways Experiment Station, Vicksburg, MS.

R7 Chicago District, Corps of Engineers. 1983. Indiana Harbor and Canal, Analysis of Sediment Samples Collected in August 1983. Chicago, IL.

R8 Crabb, N. 1986. US Army Corps of Engineers Analytical Report, Indiana Harbor.

R9 Jones, J. 1988. "Biological and Toxicological Analyses of Sediment Samples from Indiana Harbor Canal, Indiana, and Adjacent Lake Michigan." Draft Report for US Army Corps of Engineers, Chicago District.

R10 Chicago District, Corps of Engineers. 1979. Analysis of Sediment Samples Collected in September 1979. Chicago, IL.

R11 Department of Environmental Management, State of Indiana. 1988. 1986-87 305(b) Report. Indianapolis, IN.

R12 Crawford, Charles G., and Wangsness, David J. 1987. Streamflow and Water Quality of the Grand Calumet River, Lake County, Indiana, and Cook County, Illinois, October 1984. Water-Resources Investigations Report 86-4208. US Geological Survey, Indianapolis, IN.

R13 Water Division, USEPA-Region V. 1985. Master Plan for Improving Water Quality in the Grand Calumet River/Indiana Harbor Canal, Final Report. Chicago, IL.

R14 Indiana Department of Environmental Management and US Environmental Protection Agency-Region V. Not dated. Northwest Indiana Environmental Action Plan. Indianapolis, IN.

R15 Indiana Department of Environmental Management. 1985. Northwest Indiana Environmental Action Plan, Draft. Indianapolis, IN.

R16 Department of Environmental Management, State of Indiana. 1986. 1984-85 305(b) Report. Indianapolis, IN.

R17 Lake Michigan Federation. Not dated. The Grand Calumet: Exploring the River's Potential. Report of the Lake Michigan Federation. (Available from Department of Environmental Management, Indianapolis, IN.)

R18 Snow, Richard H. 1974. Water Pollution Investigation: Calumet Area of Lake Michigan. Great Lakes Initiative Contract Program Report No. EPA-905/9-74-011-A, US Environmental Protection Agency, Chicago, IL.

R19 Great Lakes Water Quality Board. 1987. 1987 Report on Great Lakes Water Quality: Appendix A, Progress in Developing Remedial Action Plans for Areas of Concern in the Great Lakes Basin. Report to the International Joint Commission. International Joint Commission for the Great Lakes, Windsor, Ontario.

R20 Brannon, James M., et al. 1989. Analysis of Impacts of Bottom Sediments from Grand Calumet River and Indiana Harbor Canal on Water Quality. Miscellaneous Paper D-89-1. US Army Engineer Waterways Experiment Station, Vicksburg, MS.

R21 HydroQual. 1984. "Grand Calumet River Wasteload Allocation Study," Project No. ISBH00100 for Indiana State Board of Health, Indianapolis, IN, by HydroQual, Inc., Mahweh, NJ.

R22 Water Quality Surveillance and Standards Branch. 1986. Indiana's Fixed Station Water Quality Monitoring Program Strategy. Office of Water Management, Department of Environmental Management, Indianapolis, IN.

R23 Division of Water Pollution Control, Indiana State Board of Health. 1981. Physical and Chemical Characteristics of the Indiana Portion of Lake Michigan, 1980-1981. Indiana Environmental Management Board, Indiana Stream Pollution Control Board, Indianapolis, IN.

R24 Environmental Laboratory. 1987. "Disposal Alternatives for PCB-Contaminated Sediments from Indiana Harbor, Indiana; Vol I." US Army Engineer Waterways Experiment Station, Vicksburg, MS.

R25 Environmental Laboratory. 1987. "Disposal Alternatives for PCB-Contaminated Sediments from Indiana Harbor, Indiana; Vol II." US Army Engineer Waterways Experiment Station, Vicksburg, MS.

R26 Redmon, Pete. 1987. "Review of Chronic Toxicity Results from the Calumet River-Indiana Harbor Canal Dischargers, Conducted Summer and Fall 1986." Memorandum for Record, 24 Feb 87. USEPA-Region V, Chicago, IL.

R27 Watson, Lee, R., and Fenlon, Joseph M. 1988. Geohydrology of the Calumet Aquifer, Northwestern Indiana. Proceedings of the Indiana Senior Academy of Science, p 36.

R28 Banaszak, Konrad J., and Fenlon, Joseph M. 1988. Water Quality in the Calumet Aquifer in a Highly Industrialized Region of Indiana. Proceedings of the Indiana Senior Academy of Science, p 36.

R29 Spacie, Anne, and Davenport, Richard. 1988. Studies on the Phototoxicity of Hydrocarbon Fractions in Grand Calumet River Sediments. Proceedings of the Indiana Senior Academy of Science, p 37.

R30 Simon, Thomas P. 1988. Sub-chronic Toxicity Evaluation of Major Point Source Dischargers in the Grand Calumet River and Indiana Harbor Canal using the Embryo-Larval Survival and Teratogenicity Test. Proceedings of the Indiana Senior Academy of Science, p 37.

R31 Bright, Greg R. 1988. Recent Water Quality in the Grand Calumet River as Measured by Benthic Invertebrates. Proceedings of the Indiana Senior Academy of Science, p 38.

R32 US Environmental Protection Agency. 1988. "US Progress in Implementing the Great Lakes Water Quality Agreement, Annex Reports to the International Joint Commission." US Environmental Protection Agency, Great Lakes National Program Office, Chicago, IL.

R33 Indiana Harbor Task Force. 1987. Indiana Harbor Newsletter. Issue No. 3 (October). US Army Corps of Engineers, Chicago District. Chicago, IL.

R34 Indiana Harbor Task Force. 1988. Indiana Harbor Newsletter. Issue No. 4 (January). US Army Corps of Engineers, Chicago District. Chicago, IL.

R35 Indiana Harbor Task Force. 1988. Indiana Harbor Newsletter. Issue No. 6 (November). US Army Corps of Engineers, Chicago District. Chicago, IL.

R36 Zapotosky, J. E., and White, W. S. Not dated. A Preliminary Draft Report on Inorganic and Organic Contaminants in the Sediments of Grand Calumet River and Indiana Harbor. Research Project 8H437-00-193, ISG #EPA-79-D-F0819. USEPA-Region V, Chicago, IL.

R37 Glatfelter, D. R., Thompson, R. E., and Nell, G. E. 1988. "Water Resources Data-Indiana, Water Year 1987." USGS-WDR-IN-87-1. US Geological Survey, Water Resources Division, Indianapolis, IN.

R38 Rud, Jerry, Parks, Neil, and Jim Stahl. 1986. "Grand Calumet River Field Trip." Office Memorandum, 21 July 1986. Office of Water Management, Department of Environmental Management, Indianapolis, IN.

R39 Organic Laboratory Section, Biology Team. 1985. "October Electrofishing and Reconnaissance Survey of the Grand Calumet River, Indiana. US Environmental Protection Agency, Central Regional Laboratory, Region V. Chicago, IL 60605.

R40 Rabenold, Patricia P. 1988. 1987 Survey of Black Terns (*Chilidonas nigra*) Breeding in Indiana. Grant Report No. 22. Nongame and Endangered Wildlife Program, Division of Fish and Wildlife, Bloomington, IN.

R41 Ross, Curtis. 1986 (12 Dec). "Chronic Bioassay, BIO-CHEM Report, Grand Calumet River, Indiana Harbor Canal." Memorandum from Curtis Ross, Director, Central Regional Laboratory, to Charles Sutfin, Director, Water Division, Environmental Protection Agency, Region V, Chicago, IL.

R42 Chicago District, Corps of Engineers. 1986 (Feb). Indiana Harbor Confined Disposal Facility and Maintenance Dredging, Lake County, Indiana. Draft Environmental Impact Statement. Chicago, IL.

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Table 1. List of Information and Data Required to Evaluate In-Place Contaminated Sediments

1. SEDIMENT DATA

Water Content	OG
Hydrous Oxides (manganese, ferrous)	EC
Total PAHs	Redox
Total PCBs (aroclors and congeners)	Sulfides
TOC	SOD
Total Solids	Volatile Solids
OM	Salinity
EP Test	NH3

CEC (plus calcium, magnesium phosphorus, potassium concentration in extractant)
Atterberg Limits
Specific Gravity Determination
Dispersion Coefficients
Sediment Particle Density
Bulk Density
Permeability
Particle Size Distribution (hydrometer method); (include sand, fine sand, silt and clay)
Wet Sediment PH (1:2 sediment to distilled water solution)
Dry Sediment PH (1:2 sediment to distilled water solution)
% Base Saturation
% Free Calcium Carbonate
Potential PH or lime requirement using titration or similar method
Total Carbon Content
Total Soluble Heavy Metal Content
Total Heavy Metal Content
Surface Runoff Suspended Solids
Wet Sediment Extractable Heavy Metal Content (DTPA preferred)
Dry Sediment Extractable Heavy Metal Content (DTPA preferred)
Depth (thickness) of Mixed Top Sediment Layer
Depth (thickness) of Contaminated Sediment Layers
Sedimentation Rate (possibly through core dating)
Sediment Deposition History
Suspended Solids Settling Rates (possibly through sediment traps)
Consolidation Characteristics
Sediment Porosity (mixed layer and deeper layers)
Pesticides
Priority Pollutants (40 CFR Part 136)
Dioxin
Reference Site

2. WATER QUALITY DATA

DOC	TOC
DO	Hardness
BOD	PH
Metals	Conductivity

(Continued)

(Sheet 1 of 3)

Table 1 (Continued)

PAHs — Temperature
PCBs — Total Solids
Total Suspended Solids (distributed in time and space)
Best Estimates of Partition Coefficients for Low (water column) and High (bottom sediments) Sediment Concentrations
Sediment-Water Contaminant Distribution Coefficients
Bacteriological Quality
Priority Pollutants
Interstitial Water Contaminant Concentration

3. WATERWAY HYDRAULICS & FLOW
   - Hydrology or Flows Through the System
   - Area of Bottom Contamination
   - Water Depth at Area of Contamination
   - Contaminant Waste Loads to System
   - Floods

4. POINT DISCHARGES INTO WATERWAY
   - Contaminant Loads Based on Concentration and Volumetric Flow Rates
   - Nonpoint Discharge
   - Combined Sewer Overflow

5. NONPOINT DISCHARGES INTO WATERWAY
   - Storm-Induced Surface Runoff
   - Groundwater: Information on Geohydrology and Groundwater Characteristics
   - Atmospheric Deposition

6. WATERSHED HYDROLOGY

7. MISCELLANEOUS INFORMATION
   - Climatological Data
   - Air quality

8. CONTAMINATED SITES
   - Hazardous waste
   - Superfund
   - Spill

9. LAND USE OF ADJACENT PROPERTIES

10. BIOASSAY TEST DATA
    - Rapid:
      - Microtox
      - *Daphnia*
      - *Ceriodaphnia*
      - *Pontoporeia*
      - Ames Test

(Continued)

Table 1 (Concluded)

Chronic:
C. tentans
Daphnia
Fathead minnows
Macroinvertebrate
Plant bioassay data:
Total PCB Content (aroclor content)
Specific PCB Congeners
PAHs
Heavy Metal Uptake
11. BIOLOGICAL DATA
Fisheries surveys, including:
body weight/size
diet/stomach contents
feeding type
lipid content
phytoplankton
zooplankton
birds
mammals
federal
state
Benthic Community
overall benthic "health"
benthic indicators/low diversity
plants
12. RISK ASSESSMENT
Human Health
Ecological

(Sheet 3 of 3)

Table 2. Sediment Characterization Studies Nearshore Lake Michigan (Source R15, Table 3.1)

	Type of Data Collected					
Study Citation	Physical and/or Chemical	Plankton	Macro-invertebrate	Fishery	Other Wildlife including birds, mammals, etc.	Endangered Species
In. State Bd. of Health 1982	X					
Snow 1974	X					
Torrey 1976	X					
IIT Research Inst. 1974	X	X	X			
Rockwell et al. 1980	X	X				
Harrison et. al. 1977						
Nalepa et. al. 1985			X			
Moxley & Allen 1973			X			
Alley & Moxley 1975			X			
Polls & Dennison 1984	X		X	X		
Gannon & Beeton 1969		X	X			
Greenwood et. al. 1986	X		X	X	X	X
USEPA 1977	X		X			
US COE 1986	X		X	X	X	X
Potos 1981	X		X			
Limno-Tech 1984	X		X			
Goodyear et. al. 1982				X		
US COE 1985	X	X	X	X	X	X
Brock 1986					X	X
City of Chicago 1984		X				

(Continued)

Table 2 (Concluded)

Study Citation	Physical and/or Chemical	Plankton	Macro-invertebrate	Fishery	Other Wildlife including birds, mammals, etc.	Endangered Species
	Type of Data Collected					
U.S. EPA 1985	X		X	X		
U.S. EPA 1987	X					
Cook 1966		X				
Polls & Dennison 1984	X		X	X		
Polls et. al. 1983	X		X			
Gannon and Beeton 1969		X	X			
Brannon et. al. 1986						
WES 1987	X		X			
Potos 1981	X		X			
USCOE 1985	X		X	X	X	X
USCOE 1986	X		X	X	X	X
USEPA 1977	X		X			
Hydroqual 1984	X					

Table 3. Sediment Characterization Studies Grand Calumet River (Source R36, Table 1)

Organization	Area Sampled (Number of Stations)	Year Sampled	Parameters	Sampling Methodology	Analytical Methods
Purdue University (Romano)	dredged (2) undredged (11)	1974	metals (4)	Ekman dredge - top 6" of sediment - frozen in plastic bags until analyzed.	Bulk sediment - AA[a]
U.S. Environmental Protection Agency - Region V	dredged (13)	1977	inorganics (11): mainly metals; organics PCB's, pesticides, PAH's (4), phenols, oil and grease; sediment characteristics; size distribution; odor, visible oil, percent total solids and percent volatile solids.	Ponar Dredge: sediment surface	Bulk sediment and elutriate analysis.[b]
U.S. Environmental Protection Agency - Region V	undredged (8); cluster of 5 stations bracketing Gary STP.	1978	inorganics (17); mainly metals; organics PCB's and PAH's (limited; sediment characteristics: percent total solids and percent volatile solids	Ponar Dredge: sediment surface	Bulk sediment analysis.[b]
Indiana State Board of Health	dredged (4); undredged (5)	1978	organics; PCB's only; sediment characteristics; visual description	Ponar Dredge: sediment surface	Bulk sediment analysis.[b]
U.S. Geologic Survey	undredged: headwater lagoons: (2)	1978	inorganics (7): mainly metals: organics PCB's and pesticides	Polyethylene Scoop - sediment surface	Bulk sediment analysis.[b]
	(2)	1979	(as above)		
	(2)	1979	organics only: PCB's and pesticides		
U.S. Army Corps of Engineers	dredged (13)	1979	inorganics (11): mainly metals; organics oil and grease only; sediment characteristics: percent total solids and percent volatiles solids	A Sprague Henwood skid mounted rotary drill to take samples, sediment samples composited to make one sample for each 3'in depth -- 3' multiples to below last dredged level.	Bulk and elutriate, analysis.[b]

(Continued)

[a]Atomic absorption.
[b]Methodology in Chemistry Laboratory Manual for Bottom Sediments and Elutriate Testing, 1979.

Table 3 (Concluded)

Organization	Area Sampled (Number of Stations)	Year Sampled	Parameters	Sampling Methodology	Analytical Methods
U.S. Environmental Protection Agency	dredged (4)	1971	inorganics (9): oil & grease, total solids, volatile solids.	Petersen Dredge	Bulk sediment analysis[b]
Heidleburg	dredged (13)	1977	inorganic (12): oil & grease, sediment characteristic size distribution, odor, percent total solids, percent volatile solids.	Ponar Dredge	Bulk and elutriate analysis[b]

Table 4. Highest Concentration of Contaminants in GC-IHC Sediments

Chemical	Highest Concentration ($\mu g/g$)	Study
Ammonia	545.0	R1
Arsenic	29.5	R25
Cadmium	45.0	R1
Chromium	1,680.0	R10
Copper	600.0	P10
Cyanide	4.4	P10
Iron	326,000	R10
Lead	1,430	R1
Manganese	382,000	R1
Mercury	2.20	R10
Nickel	140.0	R13
Zinc	4,630	R1
PCBs (total)	102.3	R25
Arochlor 1248	27.0	R20
Arochlor 1254	6.9	R13
Arochlor 1260	8.56	R10
Arochlor 1242	89.08	R10
P-cresol	4.5	P10
Chlorophenyl-phenylether	3.2	P10
Dibenzofuran	160.0	P10
Phenol	0.278	R1
Di methylphenol	3.2	P10
Di-chlorophenol	3.3	P10
Napthalene	2,033.333+/-57.735	R25
Acenapthylene	27.0	R13
Acenapthene	105.333+/- 8.083	R25
Fluorene	160.0	P10
Benzo(a)pyrene	105.667+/-16.921	R25
Fluoranthene	160.000+/-10.000	R25
Phenanthrene	206.667+/-11.547	R25
Anthracene	170.0	R13
Pyrene	3,300.0	P10
Benzo(a)anthracene	140.0	R13
Chrysene	130.0	R13
Benzo(b)-fluoranthene	200.0	R13
Benzo(k)-fluoranthene	140.0	R20
Benzo(g,h,i)-perylene	39.667+/- 4.163	R25
Dibenzo(a,h)anthracene	11.0	R13
Indeno(1,2,3-c,d)-pyrene	57.000+/-10.440	R25
Di-N-octyl phthalate	47.0	R13
Bis(2-ethylhexyl)phthalate	26.0	R13
Butyl benzyl pthalate	0.6	R13
Di-N-butyl pthalate	0.8	R13
Heptachlor epoxide	<1.0	R36
Endosulfan I	<0.05	R36
Endosulfan II	<0.02	
Endrin	<0.02	R36
Aldrin	<1.0	R36

(Continued)

Table 4 (Concluded)

Chemical	Highest Concentration (μg/g)	Study
Isodrin	<1.3	R36
Dieldrin	<0.02	R36
Chlorodane	<0.2	R36
DDT	<1.0	R36
DDD	<0.4	R36
DDE	<0.3	R36
Mirex	<0.2	R36
Methoxychlor	<2.0	R36
2,4-D	<0.5	R36
DCPA	<0.03	R36
1,2-DCB	0.04	R13
1,4-DCB	0.14	R13
HCB		

Table 5. Ranges of Water Quality Parameters in GCR-IHC

Parameter	Concentration				Source
Arsenic	0.003	-	<0.001	mg/l	R43
Cadmium	0.0007	-	<0.0001	mg/l	R43
Chromium	8.0	-	<1.0	ug/l	R12
Copper	61.0	-	<1.0	ug/l	R12
Iron	6,000	-	210	ug/l	R12
Lead	28.0	-	<1.0	ug/l	R12
Mercury	2.5	-	<1.0	ug/l	R12
Nickel	24.0	-	4.0	ug/l	R12
Zinc	410.0	-	20.0	ug/l	R12
Fecal Coliforms	270,000	-	210	mg/l	P10
Oil & Grease	20.0	-	1.3	mg/l	P10
BOD	41.0	-	1.0	mg/l	P10 R12
COD	30	-	0.5	mg/l	R12
Hardness	360	-	30	mg/l CaC03	R12
Cyanides	0.17	-	0.01	mg/l	R12
Ammonia	11.0	-	0.06	mg/l	P10 R12
Nitrogen, Kjeldahl	81.7	-	0.1	mg/l	R12
Nitrate	10.2	-	0.9	mg/l	R12
Nitrite	1.8	-	0.01	mg/l	R12
TOC	7.9	-	2.3	mg/l	R43
Phenols	64.0	-	<1.0	ug/l	R12
Total Phosphorus	0.58	-	<0.01	mg/l	R12
Ortho Phosphorus	0.30	-	<0.01	mg/l	R12
Sulfate	5,900	-	22	mg/l	R12
Fluoride	4.7	-	0.1	mg/l	R12
Chloride	438	-	11	mg/l	R12
TDS	9,100	-	162	mg/l	R12
TSS	16.0	-	<1.0	mg/l	R12
DO	9.9	-	2.9	mg/l	P10 R12
Temperature	15.0	-	35.0	Degrees C	R12
Specific Conductance	1,800	-	240	uS/cm	R12
pH	6.1	-	8.6		R12
Bis(2-ethylhexyl) phthalate	360	-	15	ug/l	R43

Table 6. Percent Water Determined in Sediments from Indiana Harbor and Canal Area (Source R1, Table 1) (see Figure 5)

Station	Percent Water
S1	60.06
S2	84.51
S2b	70.33
S3	63.32
S4	33.93
S5	37.19
S6	24.08
S7	20.31
S8a	53.13
S9a	53.86
S10	16.71
S11	53.15
S12	39.68
Potting Soil	55.26
Sand	0.00

Table 7. Carbon Content in Sediments from Indiana Harbor and Adjacent Lake Michigan (Source R1, Table 2) (see Figure 5)

	Percent Carbon		
Station	Total	Inorganic	Organic
1	15.18	2.61	12.57
2	18.31	1.47	16.84
2B	19.30	1.49	17.81
3	14.58	1.92	12.66
4	10.79	3.30	7.49
5	8.07	3.47	4.60
6	1.80	1.73	0.07
7	5.23	5.20	0.03
8A	10.36	2.72	7.64
9A	7.14	4.40	2.74
10	2.79	1.36	1.43
11	5.41	3.50	1.91
12	12.73	2.43	10.30
Potting Soil	18.02	0.28	17.74
Sand (dry)	0.17	0.03	0.14

Table 8. Concentrations of Total Phenols and Ammonia in Sediments from Indiana Harbor and Adjacent Lake Michigan (Source R1, Table 3) (see Figure 5)

Station	Phenol (ppm)	Ammonia (ppm)
1	0.042	55.8
2	0.070	545.0
2b	0.070	234.5
3	0.278	101.5
4	0.071	59.0
5	0.024	52.0
6	0.024	7.0
7	0.000	9.5
8a	0.024	58.5
9a	0.094	36.5
10	0.000	3.5
11	0.024	25.5
12	0.060	54.0
Potting Soil	0.012	32.5
Sand (Dry)	0.024	1.0
Blank #1	--	
Blank #2	--	

Table 9. PCB Concentrations in Sediments from Indiana Harbor and Adjacent Lake Michigan (Source R1, Table 4) (see Figure 5)

Station	Total PCB's (ppb)	MDL (ppb)
S1*	71.51	2.80
S2*	102.52	2.80
S2B*	BMDL	2.80
S3*	58.29	2.80
S4*	BMDL	2.80
S5*	BMDL	2.80
S6	55.61	2.80
S7	17.69	2.80
S8A	0.00	2.80
S9A	19.01	2.80
S10	68.53	2.80
S11a	494.60	2.80
S12a	4.55	2.80
Potting Soil	178.06	2.80
Sand (Dry)	23.86	2.80

Table 10. Concentrations of 26 Major, Minor, and Trace Elements in Sediments from Indiana Harbor and Adjacent Lake Michigan [ppm unless indicated] (Source R1, Table 5) (see Figure 5)

	Trace Element Concentration												
Sample No.	Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	Hg (ppb)	K
Station 1	9500	BDL	373	180	BDL	53800	23	BDL	940	235	76300	652	5620
Station 2	13000	BDL	360	313	BDL	37700	45	BDL	993	488	192000	1710	9980
Station 2B	15000	BDL	523	258	BDL	37200	45	BDL	1070	265	208000	1360	7000
Station 3	13600	BDL	550	200	5	48200	38	BDL	855	275	156000	1420	BDL
Station 4	10300	183	370	228	3	85300	28	BDL	423	BDL	149000	594	BDL
Station 5	7980	BDL	343	75	BDL	65500	13	BDL	190	55	35500	253	BDL
Station 6	2940	BDL	283	20	BDL	27400	BDL	BDL	BDL	BDL	12500	BDL	BDL
Station 7	3090	BDL	163	15	BDL	88000	BDL	BDL	BDL	BDL	10400	121	BDL
Station 8A	14000	BDL	400	128	BDL	51300	33	BDL	548	90	164000	680	BDL
Station 9A	13000	BDL	318	103	5	88800	BDL	BDL	215	BDL	31100	178	BDL
Station 10	5300	BDL	355	43	BDL	78300	BDL	BDL	195	120	21800	71	BDL
Station 11	11700	BDL	300	83	5	70300	BDL	BDL	213	BDL	23900	122	BDL
Station 12	9400	BDL	313	120	BDL	59000	30	BDL	450	110	168000	826	BDL
Potting soil	9940	BDL	BDL	140	BDL	24100	BDL	BDL	BDL	BDL	17100	132	BDL
Sand	2210	BDL	440	15	BDL	1320	BDL	BDL	BDL	BDL	3900	BDL	BDL
Det.lim.(DL)	161	130	12	3	3	39	11	25	115	36	126	5	5580

	Trace Element Concentration												
Sample No.	Mg	Mn	Mo	Na	Ni	P	Pb	Sb	Se	Si	Sn	V	Zn
Station 1	22300	2530	BDL	BDL	100	2640	1430	BDL	BDL	N.A.	318	BDL	3540
Station 2	11600	5850	BDL	BDL	115	6170	835	BDL	BDL	N.A.	340	205	4280
Station 2B	12200	6400	BDL	BDL	125	3980	910	BDL	BDL	N.A.	315	340	4700
Station 3	17700	5400	BDL	BDL	103	3800	730	BDL	BDL	N.A.	423	160	4630
Station 4	20200	38200	BDL	BDL	100	976	208	BDL	BDL	N.A.	128	203	1860
Station 5	24200	1790	BDL	BDL	50	446	95	BDL	BDL	N.A.	BDL	BDL	923
Station 6	15400	465	BDL	BDL	28	BDL	BDL	BDL	BDL	N.A.	BDL	BDL	520
Station 7	50000	573	BDL	BDL	30	323	BDL	BDL	BDL	N.A.	BDL	BDL	133
Station 8A	16300	5050	BDL	BDL	88	1390	BDL	BDL	BDL	N.A.	470	195	4250
Station 9A	37300	1700	BDL	BDL	53	527	398	BDL	BDL	N.A.	193	BDL	658
Station 10	46900	1160	BDL	BDL	48	598	BDL	BDL	BDL	N.A.	150	BDL	578
Station 11	31700	1220	BDL	BDL	50	554	BDL	BDL	BDL	N.A.	195	BDL	398
Station 12	16400	5550	BDL	BDL	70	2100	388	BDL	BDL	N.A.	268	223	2470
Potting soil	2550	658	BDL	BDL	BDL	739	BDL	BDL	BDL	N.A.	BDL	105	610
Sand	773	150	BDL	BDL	BDL	BDL	BDL	BDL	BDL	N.A.	BDL	BDL	508
Det.lim.(DL)	21	51	22	21800	27	265	94	80	63	37	110	98	47

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Table 11. Correlation Coefficients (R square) Determined from Select Metals in Indiana Harbor Sediments Versus Percent Total Organic Carbon (Source R1, Table 8) (see Figure 5)

Metal	TOC
Cr	0.940
Cd	0.887
Zn	0.843
Cu	0.724
Pb	0.648
Sn	0.538
Ni	0.102
Hg	0.000

Table 12. Concentrations of Cyanide Ion in Sediments from Indiana Harbor and Canal (Source R1, Table 9) (see Figure 5)

Station	$[CN^-]$ (µg/mL)
S1	BMDL
S2	BMDL
S2B	BMDL
S3	BMDL
S4	BMDL
S5	BMDL
S6	BMDL
S7	BMDL
S8A	BMDL
S9A	BMDL
S10	BMDL
S11	BMDL
S12	BMDL
Potting Soil	BMDL
Sand	BMDL

Note: BMDL = below mean detection limits

Table 13. Concentrations of Total PAHs in Indiana Harbor Canal Sediments [range of wavelengths: 245 to 260 nm] (Source R1, Table 10) (see Figure 5)

Station	Total PAH's (ppb)
S1	935.28
S2	141.41
S2B	181.53
S3	188.18
S4	87.33
S5	134.36
S6	1.14
S7	0.91
S8A	24.20
S9A	13.45
S10	6.43
S11a	9.41
S12a	107.53
S12b	114.85
Potting Soil	1.61
Sand	0.67

Method detection limit 0.01 mg/kg.

Table 14. Concentrations of Priority Pollutants in Sediments of the Grand Calumet River System (Source R13, Table 2.4)

Pollutant	Sediment concen-tration[1] (ug/g)	K_{oc}	Inter-stitial water concen-tration (mg/l)	Aquatic life criteria acute[2] (mg/l)	Aquatic life criteria chronic (mg/l)	Human health criteria[3] (mg/l)
Polychlorinated biphenyls						
Arochlor 1248	17	2.8×10^{5}	1.2×10^{-3}	0.002	1.4×10^{-5}	7.9×10^{-8}
Arochlor 1254	6.9	5.3×10^{5}	2.6×10^{-4}	0.002	1.4×10^{-5}	7.9×10^{-8}
Monocyclic aromatic chemicals						
1,2-Dichlorobenzene	0.04	1.7×10^{3}	5.2×10^{-3}	<1.12	<0.763	0.4
1,4-Dichlorobenzene	0.14	1.7×10^{3}	1.6×10^{-3}	<1.12	0.763	0.4
Phthalate esters						
Di-N-octyl phthalate	47	3.6×10^{9}	2.6×10^{-7}	<0.94	<0.003	--
Bis(2-ethylhexyl)phthalate	26.0	1.7×10^{5}	3.9×10^{-3}	<0.94	<0.003	--
Butyl benzyl phthalate	0.6	1.7×10^{5}	7.0×10^{-5}	<0.94	<0.003	--
Di-N-butyl phthalate	0.8	1.7×10^{5}	9.4×10^{-5}	<0.94	<0.003	34
Polycyclic aromatic hydrocarbons						
Acenaphthene	100.0	4.6×10^{3}	0.44	<1.7	--	2.8×10^{-6}
Acenaphthylene	27.0	2.5×10^{3}	0.22	<1.7	--	2.8×10^{-6}
Anthracene	170.0	1.4×10^{4}	0.24	<1.7	--	2.8×10^{-6}

(Continued)

Table 14 (Concluded)

Pollutant	Sediment concentration(1) (ug/g)	K_{oc}	Interstitial water concentration (mg/l)	Aquatic life criteria: acute(2) (mg/l)	Aquatic life criteria: chronic (mg/l)	Human health criteria(3) (mg/l)
Polycyclic aromatic hydrocarbons (cont'd)						
Benzo[a]anthracene	140.0	2.0×10^{5}	0.01	<1.7	--	2.8×10^{-6}
Benzo[b]fluoranthene	200.0	5.5×10^{5}	7.1×10^{-3}	<1.7	--	2.8×10^{-6}
Benzo[k]fluoranthene	120.0	5.5×10^{5}	4.2×10^{-3}	<1.7	--	2.8×10^{-6}
Benzo[g,h,i]perylene	38.0	1.6×10^{6}	4.7×10^{-4}	<1.7	--	2.8×10^{-6}
Benzo[a]pyrene	200.0	5.5×10^{6}	1.9×10^{-3}	<1.7	--	2.8×10^{-6}
Chrysene	130.0	2.0×10^{5}	1.2×10^{-2}	<1.7	--	2.8×10^{-6}
Dibenzo[a,h]anthracene	11.0	3.3×10^{6}	7.0×10^{-5}	<1.7	--	2.8×10^{-6}
Fluoranthene	120.0	3.8×10^{4}	6.0×10^{-2}	<4.0	--	0.042
Fluorene	98.0	3.9×10^{3}	0.48	<1.7	--	2.8×10^{-6}
Indeno(1,2,3-cd)pyrene	6.8	1.6×10^{6}	8.5×10^{-5}	<1.7	--	2.8×10^{-6}
Naphthalene	33.0	940	0.70	<1.7	--	2.8×10^{-6}
Phenanthrene	200.6	1.4×10^{4}	0.29	<1.7	--	2.8×10^{-6}
Pyrene	65.0	3.8×10^{4}	0.03	<1.7	--	2.8×10^{-6}

Table 15. Ranking of the Priority Pollutant Organics and Metals Found in the Grand Calumet River Sediments Based on a Comparison of Sediment Concentrations and USEPA Water Quality Criteria for the Protection of Aquatic Life (Source R13, Table 2-5)

Compound	Score
Ranking based on acute toxicity	
Aroclor 1248	0.61
Naphthalene	0.41
Fluorene	0.28
Acenapthene	0.26
Phenol	0.22
Phenanthrene	0.17
Anthracene	0.14
Acenapthylene	0.13
Arochlor 1254	0.13
Pyrene	0.02
Fluoranthene	1.5×10^{-2}
Benzo[a]anthracene	8.0×10^{-3}
Chrysene	7.6×10^{-3}
Benzo[b]fluoranthene	4.2×10^{-3}
Bis(2-ethylhexyl)phthalate	4.2×10^{-3}
Benzo[a]pyrene	3.2×10^{-3}
Benzo[k]fluoranthene	2.5×10^{-3}
N-Nitrosodiphenylamine	1.6×10^{-3}
1,4-Dichlorobenzene	1.5×10^{-3}
1,2-Dichlorobenzene	4.7×10^{-3}
Benzo[g,h,i]perylene	2.8×10^{-4}
Di-N-butyl phthalate	1.0×10^{-4}
Butyl benzyl phthalate	7.5×10^{-5}
Indeno(1,2,3-cd)pyrene	5.0×10^{-5}
Dibenzo[a,h]anthracene	4.1×10^{-5}
Di-N-octyl phthalate	2.8×10^{-7}
Ranking based on chronic toxicity	
Arochlor 1248	85.7
Arochlor 1254	18.8
Bis(2-ethylhexyl)phthalate	1.0
Phenol	0.07
Di-N-butyl phthalate	0.03
Butyl benzyl phthalate	0.02
1,4-Dichlorobenzene	2.1×10^{-3}
1,2-Dichlorobenzene	5.8×10^{-4}
Di-N-octyl phthalate	8.9×10^{-5}

Table 16. Ranking of the Priority Pollutant Organics and Metals Found in the Grand Calumet River Sediments Based on a Comparison of Sediment Concentrations and USEPA Water Quality Criteria for the Protection of Human Health (Source R13, Table 2-6)

Compound	Score
Non-Carcinogens	
Lead	9.0×10^3
Cadmium	5.6×10^3
Mercury	4.2×10^3
Fluoranthene	1.5
Phenol	6.7×10^{-2}
1,4-Dichlorobenzene	4.1×10^{-3}
1,2-Dichlorobenzene	1.2×10^{-3}
Di-N-butyl phthalate	2.7×10^{-6}
Carcinogens	
Arsenic	2.6×10^8
Naphthalene	2.5×10^5
Acenaphthene	1.6×10^5
Fluorene	1.8×10^5
Phenanthrene	1.02×10^5
Anthracene	8.7×10^4
Acenaphthylene	7.7×10^4
Arochlor 1248	1.5×10^4
Pyrene	1.2×10^4
Benzo[a]anthracene	5.0×10^3
Chrysene	4.6×10^3
Arochlor 1254	3.3×10^3
Benzo[b]fluoranthene	2.6×10^3
Benzo[h]fluoranthene	1.7×10^3
Benzo[a]pyrene	260
Benzo[g,h,i]perylene	170
Indeno[1,2,3-cd]pyrene	30
Dibenzo[a,h]anthracene	24
N-Nitrosodiphenylamine	1.9×10^{-2}

Table 17. Comparison of Averaged 1982 and 1984 Metals Content of Grand Calumet River Sediments (Source R13, Table 2-3)

Source	ISBH 1984	USEPA 1982
Sampling date	January 1984	October 1980
Metal	Reported Concentrations (ug/g dry wt.)	
Mercury (Hg)	0.68	0.73
Cadmium (Cd)	7	8
Arsenic (As)	18	27
Nickel (Ni)	140	98
Copper (Cu)	214	182
Chromium (Cr)	561	408
Lead (Pb)	414	1192
Zinc (Zn)	955	2687

Table 18. Results of PCB Analysis of Indiana Harbor Canal Sediment Samples (Source R7, Table 2) (see Figure 6)

Sampling location	Sample depth (feet, LWD)	Total PCB's (ppm, dry weight)
IH83-1	-17.9 to -19.9	14.9
	-19.9 to -21.9	17.5
	-21.9 to -23.9	23.6
	-23.9 to -25.4	35.1
IH83-2	-17.9 to -19.9	11.7
	-19.9 to -21.9	22.2/24.4
	-21.9 to -24.1	19.4
IH83-3	-18.8 to -20.8	16.0
	-20.8 to -22.8	26.2
	-22.8 to -23.3	30.6
IH83-3A	-18.8 to -20.8	14.0
	-20.8 to -22.8	24.7
	-22.8 to -25.0	24.3
IH83-4	-12.8 to -14.8	14.3/18.5
	-14.8 to -16.8	15.4
	-16.8 to -17.8	26.9
	-17.8 to -18.8	<0.3
IH83-5	-20.7 to -22.7	18.1
	-22.7 to -23.9	22.5
IH83-6	-21.1 to -23.1	<0.3/<0.3
	-23.1 to -24.4	<0.3
IH83-7	-18.9 to -20.9	<0.3
	-20.9 to -22.9	6.4
	-22.9 to -24.1	9.3
IH83-8	-19.9 to -21.9	23.1
	-21.9 to -23.9	69.9
	-23.9 to -25.0	115.

Concentrations of replicate samples are reported, separated by a slash.

Table 19. Chemical Characteristics of Sediment Collected Along Transect E in the Indiana Harbor Canal and Indiana Harbor, September 1987 (Source R5, Table 6) (see Figure 10)

Constituent*	Station Designation 0.6	1.3	2.7	3.8	5.4
Total Solids (%)	48.0	40.8	29.1	23.2	26.4
Total Volatile Solids (%)	6.5	9.7	20.6	19.7	20.1
Total Organic Carbon (mg/kg)	10,392	23,718	68,859	71,151	47,398
Fats, Oils and Greases (mg/kg)	12,433	32,968	74,293	59,970	104,224
Arsenic (mg/kg)	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium (mg/kg)	108.0	150.0	576.0	478.0	602.0
Iron (mg/kg)	24,000	43,100	45,000	59,900	60,900
Lead (mg/kg)	255.0	439.0	963.0	940.0	153.0
Manganese (mg/kg)	978.0	1,118.0	996.0	1,207.0	1,207.0
Nickel (mg/Kg)	30.0	50.0	120.0	70.0	90.0
Zinc (mg/kg)	930.0	1,920.0	4,280.0	3,250.0	4,120.0
Total PCBs (mg/kg)	1.45	2.23	10.14	8.06	17.30

*Expressed on a dry weight basis.

Table 20. GCR-IHC Sediment Data for 1986 (Source P10) (see Figure 7)

	Bridge	Cline	Kennedy	Indianapolis	Lake George Canal	Dickey	Background Maximum
% Volatile Solids	24 (12)	11 (15)	7 (13)	26 (30)	18 (39)	11 (20)	
antimony	3.9 (3.6)	3.8 (7.6)	1.9 (5.4)	13 (13)	6.3 (0.5)	7.0 (6.1)	0.5
arsenic	25 (26)	21 (67)	9.3 (25)	210 (68)	36 (6.0)	44 (60)	29
beryllium	1.2 (1.4)	<2.2 (1.2)	<2.2 (<2.1)	<2.4 (1.3)	<2.3 (<1.2)	<2.3 (1.2)	0.7
cadmium	2.1 (2.9)	2.8 (6.2)	1.3 (7.7)	27 (22)	4.6 (0.68)	10 (11)	1.0
chromium	220 (180)	280 (540)	75 (330)	990 (570)	930 (46)	730 (610)	50
copper	150 (180)	120 (300)	70 (220)	450 (440)	600 (17)	360 (360)	20
cyanide	4.4 (3.4)	1.5 (1.3)	0.13 (0.23)	1.0 (3.5)	0.13 (<0.13)	3.3 (1.4)	<0.1
lead	500 (730)	350 (790)	360 (870)	1100 (1200)	1100 (100)	960 (1200)	150
mercury	0.61 (0.90)	0.19 (0.78)	0.18 (1.1)	1.2 (0.89)	0.37 (0.041)	0.99 (0.65)	0.44
nickel	42 (47)	44 (69)	18 (40)	120 (180)	90 (2.3)	81 (72)	21
selenium	1.4 (1.5)	1.6 (1.8)	0.67 (1.4)	17 (42)	8.1 (0.77)	3.8 (3.0)	0.55
silver	<1.7 (3)	<1.4 (4.6)	<1.9 (2.7)	26 (15)	1.7 (<0.44)	6.0 (<1.8)	0.5
thallium	<19 (<20)	<22 (<24)	<22 (<21)	<24 (<26)	<23 (<12)	<23 (<24)	10
zinc	2,000 (2,700)	1,600 (2,900)	550 (2,100)	4,500 (3,700)	2,000 (210)	4,200 (4,300)	130
PCB-1248	14 (1.9)	6.1 (1.1)	1.1 (1.4)	1.5 (0.35)	2.0 (ND)	4.1 (3.1)	0.022
BHC	ND (ND)	0.02 (ND)	ND (ND)	0.01 (ND)	ND (ND)	ND (ND)	0.014
pentachloro-phenol	ND (ND)	ND (ND)	ND (51)	ND (ND)	ND (ND)	17 (ND)	0.003
pentachloro-anisole	ND (ND)	ND (ND)	ND (ND)	ND (3.9)	ND (ND)	ND (ND)	
napthalene	220 (11)	6.5 (3.8)	ND (ND)	2.5 (ND)	ND (ND)	ND (ND)	
bis (2-ethyl-hexyl) phthalate	21 (ND)	ND (ND)	ND (ND)	11 (ND)	ND (ND)	27 (ND)	
methylnaph-thalene	ND (11)	4.2 (3.7)	ND (ND)	3.0 (ND)	ND (ND)	ND (ND)	
diethylph-thalate	ND (ND)	ND (62)	ND (ND)	5.8 (ND)	ND (ND)	ND (ND)	
fluorene	160 (ND)	5.9 (ND)	ND (ND)	ND (ND)	12 (ND)	ND (ND)	

(Continued)

Table 20 (Concluded)

	Bridge	Cline	Kennedy	Indianapolis	Lake George Canal	Dickey
fluoranthene	ND (24)	44 (8.6)	ND (ND)	ND (ND)	ND (ND)	ND (ND)
pyrene	3,300 (22)	49 (6.7)	ND (ND)	ND (ND)	ND (ND)	ND (ND)
dibenzofuran	160 (5.1)	ND (ND)	ND (ND)	ND (ND)	ND (ND)	ND (ND)
acenapthene	ND (4.5)	ND (ND)	ND (ND)	ND (ND)	ND (ND)	ND (ND)
1-2 dichloro-benzene	ND(1.5)	ND (ND)	ND (ND)	ND (ND)	ND (ND)	ND (ND)
chloronaph-thalene	6.5 (ND)	ND (ND)	ND (ND)	ND (ND)	ND (ND)	ND (ND)
benzoanth-racene	47 (ND)	ND (ND)	ND (ND)	17 (ND)	ND (ND)	ND (ND)
benzofluor-anthene	ND (ND)	ND (ND)	ND (11)	ND (ND)	ND (ND)	ND (4.0)
4-nitroaniline	ND (ND)	ND (ND)	ND (ND)	ND (ND)	ND (ND)	13 (ND)
chlorophenyl-phenylether	ND (ND)	ND (ND)	ND (ND)	ND (ND)	ND (ND)	4.0 (ND)
p-cresol	ND (ND)	ND (ND)	ND (ND)	4.5 (ND)	ND (ND)	ND (ND)
dimethyl-phenol	ND (ND)	ND (ND)	3.2 (2.0)	ND (ND)	ND (ND)	ND (ND)
dichloro-phenol	ND (ND)	ND (ND)	3.3 (2.8)	ND (ND)	ND (ND)	ND (ND)

ND = Not Detected

Table 21. Sediment Organic Concentrations in the Grand Calumet River (Source R20, Table 11)

Organic	Sediment Concentration, ppm This Study	Sediment Concentration, ppm USEPA (1985)	Estimated Interstitial Concentration, ppb
PCBs (1248)	27	17	1.3
Naphthalene	2000	33	28.6
Acenaphthylene	22	27	0.12
Acenaphthene	96	100	0.28
Fluorene	69	98	0.22
Phenanthrene	200	201	0.2
Anthracene	62	170	0.06
Fluoranthene	150	120	5.07
Pyrene	140	65	0.04
Chrysene	92	130	0.57
Benzo(a)anthracene	86	140	0.04
Benzo(b)fluoranthene	140	200	3.38
Benzo(k)fluoranthene	140	120	3.31
Benzo(a)pyrene	87	200	0.54
Indeno(1,2,3-cd)pyrene	50	6.8	42.2
Benzo(g h i)perylene	35	38	2.91

Table 22. Estimated Fluxes for PCBs in the GCR-IHC Ecosystem*
(Source R20, Table 13)

Location**	Sediment Concentration mg/kg	Interstitial Water Concentration μg/ℓ	Estimated Flux† $ng/m^2/day \times 10^{-5}$	Max Conc. at 2% Lipid ppm
1	13.15	0.93	9.2	6.8
2	5.86	0.41	4.0	3.0
3	27.38	1.90	18.9	14.2
4	11.34	0.80	7.9	5.9
5	31.74	2.24	22.3	16.5
6	22.93	1.62	16.1	11.9
7	7.36	0.52	5.1	3.8
8	1.11	0.08	0.7	0.6
9	3.13	0.22	2.1	1.6
10	1.89	0.13	1.2	1.0
11	nd††	nd	nd	nd
12	0.09	0.006	0.[illegible]	0.05
13	nd	nd	nd	nd

* Hypothetical maximum whole organism concentration of PCBs in organism with lipid content of 2 percent.

** Locations are the same as those used in US Army Engineer District, Chicago (1979).

† PCB concentration in overlying water is 0.8×10^{-5} mg/ℓ.

†† nd = less than detection level (e.g. <0.02 ppm).

Table 23. GCR-IHC Sediment Analysis Results (Source R10, Table 2) (see Figure 8)

Parameter	1-1-4	1-5-8	1-9-12	1-13-16	1-17-21	2-1-4	2-5-8	2-9-12	3-3-6	3-7-10
Total Solids, %	27.9	29.2	36.7	44.1	45.3	49.3	54.5	75.1	26.3	32.2
Volatile Solids, %	28.5	28.7	22.1	19.7	15.2	22.1	21.1	4.9	28.1	23.2
Chemical Oxygen Demand	265,700	269,200	189,100	208,300	160,700	257,000	234,500	57,300	311,700	224,200
Total Kjeldahl Nitrogen	10,500	10,800	8,200	6,200	4,100	2,500	2,500	880	9,100	7,500
Ammonia Nitrogen	3,000	3,900	2,900	2,300	1,800	370	390	250	1,900	1,700
Total Phosphorus	7,600	8,600	7,400	7,600	5,200	2,700	2,200	1,500	7,900	7,200
Oil and Grease	65,400	54,700	66,600	51,300	44,600	175,100	119,100	15,800	96,600	86,500
Mercury	2.1	2.1	2.2	1.3	1.0	1.4	0.8	<0.2	2.2	1.9
Lead	1,040	1,170	1,250	1,420	1,200	3,720	4,700	480	1,040	1,090
Zinc	4,100	4,700	7,200	8,600	8,400	9,100	9,900	530	4,900	5,800
Manganese	1,980	2,060	2,900	3,770	4,230	990	1,270	510	2,020	2,190
Nickel	210	350	150	100	80	170	140	34	220	210
Arsenic	42	64	50	78	40	54	62	13	39	41
Cadmium	13	15	13	16	17	37	30	3	12	11
Chromium	790	890	1,380	1,680	980	460	400	24	850	940
Magnesium	10,400	10,500	9,200	7,540	5,980	21,800	16,800	29,140	10,770	10,350
Copper	350	360	260	220	190	310	270	36	380	250
Iron	164,600	171,400	240,000	241,200	326,000	85,800	123,400	32,800	169,200	180,400
PCB's										
Aroclor 242	13.15	2.19	56.40	64.40	51.66	5.86	0.86	<0.02	27.38	12.83
Aroclor 248	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Aroclor 254	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Aroclor 260	2.04	8.56	2.34	3.56	2.25	2.07	0.16	0.02	2.02	1.52
Total PCB	15.19	10.75	58.74	67.96	53.91	7.93	1.02	0.02	29.40	14.35

(Continued)

(Sheet 1 of 3)

Table 23 (Continued)

Parameter	3-11-14	3-15-18	4-5-8	4-9-12	4-13-16	5-3-6	5-7-10	6-1-4	6-5-8	7-3-4	7-5-6	8-1-2	8-3-4
Total Solids, %	49.2	55.6	40.3	56.9	59.7	59.2	82.2	55.6	53.1	60.2	65.7	75.8	77.0
Volatile Solids, %	21.5	18.9	19.8	21.1	20.5	10.7	7.1	21.8	24.5	16.6	19.6	8.1	6.9
Chemical Oxygen Demand	194,800	207,000	224,700	198,400	200,000	122,100	43,900	314,400	315,700	277,500	267,100	92,000	57,300
Total Kjeldahl Nitrogen	4,300	3,300	4,300	3,500	3,200	1,600	740	3,200	3,400	2,400	2,000	1,100	900
Ammonia Nitrogen	1,000	980	700	900	960	130	70	510	750	620	570	110	100
Total Phosphorus	6,800	4,200	3,300	2,400	2,300	2,300	410	3,200	4,200	1,700	1,200	730	800
Oil and Grease	87,700	98,500	97,500	106,100	96,000	43,200	550	65,700	67,700	41,600	26,400	8,600	2,200
Mercury	1.3	0.7	2.4	1.0	2.5	0.6	<0.2	1.2	1.5	0.8	0.9	0.2	<0.2
Lead	980	1,360	1,600	1,550	1,410	530	22	630	770	450	360	140	40
Zinc	7,700	6,300	6,100	5,700	5,100	3,700	80	3,500	5,000	3,100	2,600	1,200	330
Manganese	2,820	2,460	1,590	1,460	1,460	1,290	470	2,360	2,650	2,760	3,450	880	490
Nickel	120	79	82	36	27	57	36	110	87	76	62	39	35
Arsenic	56	62	91	93	81		64	40	49	43	40	23	16
Cadmium	15	4	20	24	25	9	<1	8	9	6	9	5	1
Chromium	1,330	710	290	72	62	440	16	370	430	250	120	80	40
Magnesium	8,500	9,950	15,160	17,460	17,780	21,600	27,590	13,290	10,910	11,050	5,800	22,660	28,720
Copper	270	250	300	260	100	150	32	270	240	203	120	54	28
Iron	232,000	238,000	174,800	180,400	176,800	91,600	22,400	219,700	216,800	238,500	271,700	81,800	34,000
PCB's													
Aroclor 1242	39.65	20.45	11.34	<0.02	<0.02	31.74	<0.02	22.93	89.08	7.36	2.47	1.11	0.84
Aroclor 1248	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Aroclor 1254	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Aroclor 1260	2.50	1.26	0.37	0.08	0.12	1.82	<0.02	0.74	0.14	0.76	0.35	0.20	0.05
Total PCB	42.15	21.71	11.71	0.08	0.12	33.56	<0.02	23.67	89.22	8.12	2.82	1.31	0.89

(Continued)

Table 23 (Concluded)

Parameter	9-1-2	9-3-4	9-5	10-5-6	10-7-8	11-1-2	11-3-4	12-1-2	12-3-5	13-1-2	13-3-4
Total Solids, %	41.8	41.4	46.7	43.3	51.1	75.7	78.9	56.3	42.0	81.7	78.4
Volatile Solids, %	18.1	19.3	13.1	17.6	13.6	3.7	4.0	7.4	12.3	2.6	3.1
Chemical Oxygen Demand	382,600	415,700	290,700	304,500	232,400	37,900	62,000	163,300	186,500	29,100	41,700
Total Kjeldahl Nitrogen	2,400	2,500	1,800	2,600	2,000	680	750	2,100	1,900	480	700
Ammonia Nitrogen	450	670	560	570	450	50	30	340	300	10	<10
Total Phosphorus	1,300	2,700	780	1,500	1,400	740	680	1,800	1,700	600	600
Oil and Grease	100,500	76,000	69,100	49,600	40,200	510	680	26,900	27,200	310	520
Mercury	0.6	0.7	0.5	0.5	0.5	<0.2	<0.2	0.3	0.4	<0.2	<0.2
Lead	630	630	600	520	470	18	20	490	300	18	16
Zinc	2,300	4,700	3,100	4,400	3,900	80	80	4,300	1,700	110	50
Manganese	2,500	2,820	2,490	1,750	1,600	390	390	1,920	1,230	430	390
Nickel	110	120	110	74	70	32	34	54	36	22	24
Arsenic	65	101	80	63	68	12	12			18	14
Cadmium	5	6	5	9	9	<1	<1	8	7	<1	<1
Chromium	160	280	140	300	260	16	14	250	100	11	11
Magnesium	8,890	7,810	8,000	11,620	14,160	26,610	25,250	21,480	24,600	24,680	25,730
Copper	280	280	240	180	160	22	30	160	90	14	20
Iron	266,000	322,500	229,800	216,700	203,600	22,200	23,200	147,200	85,700	20,000	21,600
PCB's											
Aroclor 1242	3.13	5.41	11.47	1.89	7.67	<0.02	0.03	0.09	1.90	<0.02	<0.02
Aroclor 1248	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Aroclor 1254	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Aroclor 1260	0.45	1.06	0.49	1.06	1.12	<0.02	<0.02	0.57	0.45	<0.02	<0.02
Total PCB	3.58	6.47	11.96	2.95	8.79	<0.02	0.03	0.66	2.35	<0.02	<0.02

Table 24. Elutriate Test Results for Indiana Harbor (Source R10, Table 3) (see Figure 8)

Parameter	Units	Elutriate Water Without Sediment	Elutriate Water Using Sediments at Each Station										
			1-1-4	1-5-8	1-9-12	1-13-16	1-17-21	2-1-4	2-5-8	2-9-12	3-3-6	3-7-10	3-11-14
COD	mg/ℓ	8	100	147	136	162	154	99	76	27	84	70	110
TOC	mg/ℓ	5	36	44	46	63	63	38	21	9	32	22	31
TKN	mg/ℓ	4.7	128.6	164.0	144.0	136.8	117.8	21.0	19.6	18.3	75.8	71.8	45.3
Ammonia-N	mg/ℓ	3.7	120.0	157.8	138.1	131.0	106.5	17.0	17.1	14.8	74.0	71.0	44.0
Nitrate+Nitrite-N	mg/ℓ	0.85	0.35	0.29	0.40	0.39	3.05	3.36	3.30	3.59	2.98	3.20	3.45
Total P	mg/ℓ	0.04	0.28	0.31	0.32	0.70	0.28	0.04	<0.02	<0.02	0.11	0.17	0.09
Cyanide	mg/ℓ	0.020	0.024	0.034	0.030	0.065	0.040	0.025	0.018	0.020	0.024	0.024	0.021
Phenols	mg/ℓ	<0.010	0.018	0.018	0.015	0.031	0.035	0.035	0.035	0.013	0.010	0.013	0.026
Arsenic	µg/ℓ	<2	7	5	9	21	8	4	12	4	6	7	5
Mercury	µg/ℓ	<0.2	0.2	0.4	<0.2	<0.2	0.6	0.5	0.4	0.3	<0.2	<0.2	<0.2
Cadmium	µg/ℓ	<1	3	<1	<1	<1	1	<1	<1	<1	<1	<1	<1
Chromium	µg/ℓ	1	10	9	26	160	49	4	2	1	5	17	11
Copper	µg/ℓ	12	14	12	14	44	21	68	79	19	18	21	25
Lead	µg/ℓ	20	23	34	78	36	40	32	73	29	28	29	35
Nickel	µg/ℓ	8	44	46	57	61	43	96	140	22	15	27	23
Zinc	µg/ℓ	34	36	32	141	400	344	31	50	34	40	102	34
Iron	µg/ℓ	80	117	110	324	1010	721	288	231	70	85	128	75
Magnesium	mg/ℓ	16.5	12.4	7.5	8.8	3.9	5.2	12.7	44.8	17.4	13.1	13.1	19.2
Manganese	µg/ℓ	<10	<10	<10	<10	<10	<10	51	67	26	35	24	96
Aluminum	µg/ℓ	30	400	340	350	950	250	110	320	60	240	240	140

(Continued)

Table 24 (Continued)

Parameter	Units	Elutriate Water Using Sediments at Each Station												
		3-15-18	4-5-8	4-9-12	4-13-16	5-3-6	5-7-10	6-1-4	6-5-8	7-3-4	7-5-6	8-1-2	8-3-4	9-1-2
COD	mg/ℓ	69	100	122	113	76	19	80	102	86	58	29	21	62
TOC	mg/ℓ	23	29	43	33	23	8	23	31	36	27	13	8	26
TKN	mg/ℓ	52.8	47.4	73.8	74.5	10.2	5.4	39.3	58.2	22.3	23.0	6.8	7.4	33.2
Ammonia-N	mg/ℓ	50.4	42.7	69.0	71.3	8.2	5.0	35.1	53.2	18.3	18.5	5.3	5.4	29.4
Nitrate+Nitrite-N	mg/ℓ	3.50	4.21	3.21	3.47	3.32	3.68	3.49	3.24	3.20	3.44	3.85	3.40	3.13
Total P	mg/ℓ	<0.02	0.04	0.08	0.07	0.03	<0.02	0.05	0.07	<0.02	<0.02	<0.02	<0.02	0.06
Cyanide	mg/ℓ	0.025	0.025	0.032	0.047	0.018	0.020	0.019	0.031	0.043	0.062	0.019	0.018	0.018
Phenols	mg/ℓ	0.018	0.026	0.040	0.035	0.022	0.022	0.040	0.053	0.062	0.057	0.044	0.022	0.026
Arsenic	μg/ℓ	10	9	7	20	5	5	<2	9	5	4	<2	<2	4
Mercury	μg/ℓ	0.3	0.2	0.3	0.6	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Cadmium	μg/ℓ	<1	<1	<1	1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chromium	μg/ℓ	12	3	4	5	6	3	12	17	10	2	1	1	2
Copper	μg/ℓ	13	30	22	20	23	20	22	26	16	13	14	32	22
Lead	μg/ℓ	69	58	52	35	35	60	22	90	82	70	15	12	24
Nickel	μg/ℓ	14	20	16	18	18	8	19	24	18	14	8	22	50
Zinc	μg/ℓ	106	64	220	255	42	35	82	130	48	32	38	39	354
Iron	μg/ℓ	181	105	504	880	80	70	117	160	900	116	60	183	110
Magnesium	mg/ℓ	8.5	20.4	9.5	6.5	28.2	23.4	19.8	15.1	17.5	16.9	14.8	27.1	35.7
Manganese	μg/ℓ	26	65	16	14	94	55	64	38		205	58	172	70
Aluminum	μg/ℓ	90	370	140	220	50	280	160	200	120	60	30	40	90

(Continued)

Table 24 (Concluded)

Parameter	Units	Elutriate Water Using Sediments at Each Station									
		9-3-4	9-5	10-5-6	10-7-8	11-1-2	11-3-4	12-1-2	12-3-5	13-1-2	13-3-4
COD	mg/ℓ	112	104	76	79	12	14	85	64	30	21
TOC	mg/ℓ	46	43	30	26	7	7	30	20	8	6
TKN	mg/ℓ	65.4	60.6	39.3	41.3	4.4	4.4	26.7	17.6	3.7	3.7
Ammonia-N	mg/ℓ	52.8	51.4	35.9	37.2	3.9	3.8	26.1	17.3	3.5	3.6
Nitrate+Nitrite-N	mg/ℓ	2.87	3.08	3.20	3.20	3.64	3.50	3.14	3.46	4.17	3.88
Total P	mg/ℓ	0.04	0.06	0.06	0.07	<0.02	<0.02	0.03	<0.02	< 0.02	<0.02
Cyanide	mg/ℓ	0.040	0.033	0.018	0.024	0.018	0.018	0.017	0.019	0.023	0.021
Phenols	mg/ℓ	0.096	0.125	0.031	0.031	0.048	0.044	0.022	0.018	0.058	0.058
Arsenic	μg/ℓ	6	8	4	5	<2	<2	<2	<2	<2	<2
Mercury	μg/ℓ	<0.2	0.6	<0.2	0.2	<0.2	<0.2	<0.2	<0.2	0.3	<0.2
Cadmium	μg/ℓ	<1	<1	<1	<1	2	<1	<1	<1	<1	<1
Chromium	μg/ℓ	1	2	3	3	2	2	4	3	1	2
Copper	μg/ℓ	24	14	19	14	29	51	20	24	11	22
Lead	μg/ℓ	30	90	33	24	14	16	22	26	16	18
Nickel	μg/ℓ	30	15	23	15	25	21	22	17	9	17
Zinc	μg/ℓ	36	51	618	34	32	60	90	35	30	37
Iron	μg/ℓ	95	258	205	289	60	72	166	72	239	121
Magnesium	mg/ℓ	19.6	20.0	12.6	11.6	23.6	26.0	18.8	20.8	21.2	23.5
Manganese	μg/ℓ	38	34	22	22	83	135	128	155	48	39
Aluminum	μg/ℓ	70	80	30	30	40	390	150	40	70	60

(Sheet 3 of 3)

Table 25. Comparative Chemical Composition of Indiana Harbor and Lake Michigan Sediments (Source R24, Table 2)

Parameter	Concentration in Sediment, mg/kg dry weight	
	Indiana Harbor	Lake Michigan
Metals		
Arsenic	29.5	10.1
Cadmium	20.0	0.1
Chromium	650.0	4.4
Lead	879.0	11.9
Mercury	0.5	BD*
Zinc	4,125.0	54.1
Pesticides		
Aldrin	2.55	0.0006
Polyaromatic hydrocarbons		
Acenaphthene	96	BD
Acenaphthylene	22	BD
Anthracene	62	BD
Benzo(a)anthracene	86	BD
Benzo(b)fluoranthene	140	BD
Benzo(a)pyrene	87	BD
Benzo(g h i)perylene	35	BD
Chrysene	92	BD
Fluoranthene	150	BD
Fluorene	69	BD
Indeno(1,2,3-c d)pyrene	50	BD
Naphthalene	2,000	0.46
Phenanthrene	200	BD
Pyrene	140	BD
Polychlorinated biphenyls		
PCB-1248	33.4	BD
PCB-1254	BD	0.013
Total organic carbon	7.39% of sediment weight	1.83% of sediment weight
Total inorganic carbon	2.28% of sediment weight	0.47% of sediment weight
Oil and grease	3.88% of sediment weight	1.71% of sediment weight
Phenol	3	BD

* BD = below detection.

Table 26. Analysis of Sediment Samples from Chicago River and Harbor and Calumet River and Harbor Collected April 27-28, 1981 (Source R9, Table 1)

LOCATION	Moisture (%)	CN	AS	BA	CD	CR	PB	AG	HG
CALUMET HARBOR 2A - near N. break-wall	52.7	.48	21	168	17	117	255	<5	<.1
CALUMET HARBOR IN - N. line of CDF, 500' E of PL	40.5	.5	18	53	16	133	276	<5	<.1
CALUMET HARBOR 2E - E. line of CDF on fence line	42.4	.19	23	112	13	133	242	<5	<.1
CALUMET RIVER 5 - Division bwtn. Harbor/River	45.1	1.16	18	185	23	152	393	<5	<.1
CALUMET RIVER 10 - 106th St.	33.2	1.72	24	99	28	88	400	<5	.2
CALUMET RIVER 13 - Turning Basin #3	33.9	1.44	46	64	<5	136	656	<5	.2
CHICAGO HARBOR 15 - outer Harbor	50.4	<.13	33	91	18	155	254	<5	<.1
CHICAGO HARBOR 14 - Inner Harbor	32.4	<.13	29	57	<5	72	222	<5	.3
CHICAGO RIVER 12 - Lake Shore Drive	51.3	.27	30	56	31	101	457	<5	<.1
CHICAGO RIVER 10 - N. Clark St.	37.7	.17	14	106	40	114	473	128	<.1

All units expressed as mg/kg dry weight except as noted otherwise.

Table 27. Polution Classification of Sediments Collected from Chicago River Harbor and Calumet River and Harbor (Source R9, Table 2)

Classification	Cn	As	Ba	Cd	Cr	Pb	Hg
Non-polluted	- 2/	0	0	2	0	0	10
Moderately polluted	2	0	3	-	1	0	-
Heavily polluted 1/	6	10	7	8	9	10	0

Ten samples analyzed.

1/ Cadmium and Mercury is classified as polluted or not with no intermediate classification.

2/ Classified as non-polluted: below detection limit which is above non-polluted concentration. Therefore two samples cannot be classified for Cn.

Table 28. Elutriate Analysis of Sediment Samples from Calumet River and Harbor (Source R9, Table 3)

LOCATION	SAMPLE	CN	AS	BA	CD	CR	PB	AG	HG
CALUMET HARBOR	Elutriate	<20	<1	52.7	<1	<1	<2	<.1	<1
2A - near N. breakwall	Water	<20	<1	22.1	<1	<1	<2	<.1	<1
CALUMET HARBOR	Elutriate	<20	12	77.9	<1	<1	<2	<.1	<1
IN - N. line of CDF, 500' E. of PL	Water	<20	<1	21	<1	<1	<2	<.1	<1
CALUMET HARBOR	Elutriate	<20	3	76	<1	6	<2	<.1	<1
2E - E. line of CDF on fence line	Water	<20	<1	21.6	<1	<1	<2	<.1	<1
CALUMET RIVER	Elutriate	<20	2	44.9	<1	<1	<2	<.1	<1
5 - division between Harbor/River	Water	<20	1	22.7	<1	<1	<2	<.1	<1
CALUMET RIVER	Elutriate	<20	2	67.2	<1	<1	<2	<.1	<1
10 - 106th St.	Warer	<20	<1	24	<1	<1	<2	<.1	<1
CALUMET RIVER	Elutriate	<20	3	66.8	<1	12	<2	<.1	<1
13 - Turning basin #3	Water	<20	<1	28.5	<1	<1	<2	<.1	<1

All units expressed as µg/liter

Table 29. Fixed Station Water Quality Data (Source P10) (see Figures 16 and 17)

Standard		Time	D.O.	BODs	Temp	Field pH	Lab pH	NH, -N	Chlo- rides	Cm	Fluo- ride	Total P	Sul- fates	TDS	Total Cr	Diss. Fe	Pb	Hg	Total PCBs	Phenols	Fecal Colif.	Oil Grease
			4.0					0.05	12.5	0.1	1.50		22.5	560	25	200	25	0.5	0.001	10		
1985	Jan 22	1030	6.0	8.0	8°	7.4	7.2	10.3*	140*	0.52	N.S.	.39	120	N.S.	<10	N.S.	10	0.1	N.S.	<5	120	3.1
	Feb 21	1245	4.4	20.0	12°	7.2	7.0	9.9*	190*	<.005	N.S.	.85	270*	N.S.	<10	N.S.	20	0.1	N.S.	5	45,000	6.6
	Mar 21	1130	6.0	41.0	12°	7.3	7.1	8.9*	150*	.015	N.S.	.34	120	N.S.	<10	N.S.	40*	0.3	N.S.	<5	23,000	8.3
	Apr 19	1240	6.2	3.2	15°	7.3	7.3	6.9*	170*	.023	N.S.	.24	130	N.S.	<10	120	10	<0.1	N.S.	<5	2,500	5.1
	May 13	1200	4.1	7.3	18°	7.0	7.1	8.2*	143*	.009	N.S.	.20	100	N.S.	<10	100	10	0.1	N.S.	<5	250	4.9
	June 20	1130	3.8*	10.0	22°	7.0	7.1	3.2*	130*	.025	N.S.	.42	87	N.S.	<10	160	20	0.1	N.S.	<5	2,300	6.9
	July 18	1200	3.2*	4.6	27°	N.S.	7.1	0.9*	130*	.027	N.S.	.40	110	N.S.	<10	150	20	<0.1	N.S.	<5	290	2.8
	Aug 22	1240	4.0*	14.0	25°	7.4	7.1	1.0*	130*	.015	N.S.	.92	130	N.S.	<10	180	20	0.2	N.S.	<5	210	2.2
	Sept 19	1150	5.2	3.8	25°	7.2	7.3	0.5	140*	<.005	N.S.	.33	120	N.S.	<10	120	20	0.1	N.S.	<5	50,000	1.3
	Oct 31	1235	4.5	5.0	17°	7.2	7.1	1.7	140*	.057	N.S.	.25	130	N.S.	<10	130	20	0.1	N.S.	<5	25,000	2.5
	Nov 21	1300	2.5*	>84	14°	N.S.	7.1	4.6*	110	.021	N.S.	2.3	130	N.S.	<10	190	120*	1.9*	N.S.	8	270,000	5.8
	Dec 19	1200	8.0	15.0	6°	6.9	7.4	11.0*	160*	.180*	N.S.	.38	140	N.S.	<10	180	20	0.1	N.S.	<5	2,700	4.2
1986	Jan 16	1100	4.2*	N.S.	9°	7.0	7.4	9.5*	N.S.	.041	N.S.	.49	N.S.	N.S.	<10	190	10	0.3	N.S.	5	8,200	N.S.
	Feb 20	1210	5.8	62	8°	7.0	7.4	9.3*	N.S.	.106*	N.S.	2.40	N.S.	N.S.	<10	220	80*	1.9*	N.S.	8	170,000	11.0
	Mar 20	1220	5.2	N.S.	10°	7.2	7.4	8.5*	N.S.	.038	N.S.	.50	N.S.	N.S.	<10	N.S.	10	0.2	N.S.	7	22,000	4.6
	Apr 17	1200	5.2	5.4	11°	7.4	7.4	5.4*	N.S.	.035	N.S.	.30	N.S.	N.S.	<10	160	10	0.1	N.S.	N.S.	7,900	2.6
	May 22	1200	4.6*	N.S.	17°	7.1	7.4	3.7*	N.S.	.035	N.S.	.32	N.S.	642*	<10	150	10	0.1	N.S.	<5	4,000	N.S.
	June 20	1200	3.6*	5.4	25°	7.5	7.5	2.4*	N.S.	.043	N.S.	.40	N.S.	644*	<10	240	30	0.2	N.S.	<5	5,600	7.6
	July 17	1130	2.0*	N.S.	28°	6.8	7.3	4.2*	N.S.	.031	N.S.	.49	N.S.	624*	<10	180	20	0.4	N.S.	5	4,100	11.0
	Aug 21	1400	2.3*	7.5	24°	7.1	7.4	2.8*	N.S.	.034	N.S.	.52	N.S.	615*	<10	160	10	0.2	N.S.	7	3,800	20.0
	Sept --	No samples taken. Bridge reconstruction prevents access.																				
	Oct 9	1000	2.2*	10.0	17°	7.1	7.5	2.0*	N.S.	.027	N.S.	.52	N.S.	716*	<10	150	20	0.2	N.S.	<5	33,000	N.S.
	Nov 20	1130	6.2	N.S.	5°	N.S.	7.4	4.3*	N.S.	.135	N.S.	.57	N.S.	659	<10	160	40	0.1	N.S.	<5	40,000	N.S.
	Dec 18	1140	7.0	5.9	9°	7.3	7.5	6.2*	N.S.	.070	N.S.	.24	N.S.	685	<10	210	10	<0.1	N.S.	7	4,500	4.0
1987	Jan 29	1155	8.0	N.S.	6°	7.2	7.5	8.7*	N.S.	N.S.	N.S.	.39	N.S.	716	<10	130	20	0.1	N.S.	11	8,400	N.S.
	Feb 19	1230	9.2	6.4	8°	7.4	7.7	6.1*	N.S.	<.005	N.S.	.30	N.S.	597	<10	120	10	<0.1	N.S.	8	14,000	3.0
	Mar		9.2	N.S.	8°		7.6	7.2*	N.S.	.028	N.S.	.24	N.S.	577	<10	N.S.	10	<0.1	N.S.	6	2,900	2.0
	Apr		2.9*	7.6	18°		7.8	7.7*	N.S.	.175	N.S.	.56	N.S.	901	<10	N.S.	18	<0.1	N.S.	13	5,000	N.S.
	May		0*	N.S.	22°		7.2	3.8*	N.S.	.019	N.S.	1.70	N.S.	644	<10	280	88	0.2	N.S.	<5	6,000	N.S.
	June		1.4*	6.1	29°		7.5	6.0*	N.S.	.048	N.S.	0.62	N.S.	686	<10	230	24	<0.1	N.S.	<5	9,000	N.S.

N.S. = not sampled.

* Violation of 330 IAC 2-2-5.

Table 30. Water Quality Data from the Indiana Harbor USACOE Project Area (Source R8)

Result Units: mg/l

PARAMETER / SEI ID STATION NO.	4975-6 #1	4975-7 #2	4975-8 #3	4975-9 #4	4975-10 #5	4975-11 #6	4975-12 #7	4975-13 #8
Arsenic (0.001)	0.002	0.003	0.003	0.002	0.002	<0.001	<0.001	0.001
Cadmium (0.0001)	0.0003	0.0001	0.0004	<0.0001	0.0007	0.0002	0.0006	0.0007
Chromium (0.002)	<0. [illegible]	<0.002	<0.002	ND	ND	<0.002	0.002	<0.00?
Copper (0.001)	0.003	0.002	0.003	0.002	0.002	0.003	0.003	0.00[illegible]
Iron (0.002)	0.071	0.031	0.006	0.002	0.002	0.003	0.005	0.019
Lead (0.001)	0.002	0.001	<0.001	0.001	0.001	0.001	<0.001	0.001
Manganese	--	--	--	--	--	--	--	--
Mercury (0.0001)	ND	ND	ND	0.0002	ND	ND	ND	ND
Nickel (0.002)	0.007	0.007	0.007	0.005	0.006	0.003	0.004	0.003
Selenium (0.001)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc (0.01)	<0.01	<0.01	0.02	0.02	0.01	0.01	<0.01	0.02
COD (4.0)	ND	ND	ND	4.2	ND	ND	ND	<4.0
Coliform, Fecal	--	--	--	--	--	--	--	--
Cyanides, Total (0.01)	ND	<0.01	ND	<0.01	ND	ND	<0.01	<0.01
Hardness, Total (1)	155	159	151	146	138	141	155	149
Nitrogen, Ammonia (0.10)	0.21	0.16	0.17	0.16	0.12	0.16	0.18	0.17
Nitrogen, Kjeldahl (0.10)	ND	ND	ND	ND	ND	ND	ND	ND
Oil & Grease (0.5)	ND	ND	ND	ND	ND	ND	ND	ND
TOC (0.5)	7.9	3.1	2.5	2.3	2.4	2.8	3.1	2.4
Phenols	--	--	--	--	--	--	--	--
Phosphorus, Total (0.02)	0.03	0.03	0.02	0.02	0.02	<0.02	0.05	0 [illegible]4
TDS (1.0)	174	170	184	186	160	164	170	165
TSS (1.0)	8.0	8.0	6.0	7.0	7.0	37.0	18.0	18.0

ND - Not detected, detection limit in ()
< - Below detection limit

(Continued)

Table 30 (Continued)

Result Units: mg/l

PARAMETER SEI ID STATION NO.	4975-14 #9
Arsenic (0.001)	<0.001
Cadmium (0.0001)	0.0002
Chromium (0.002)	<0.002
Copper (0.001)	0.003
Iron (0.002)	0.013
Lead (0.001)	0.001
Manganese	--
Mercury (0.0001)	ND
Nickel (0.002)	0.003
Selenium (0.001)	<0.001
Zinc (0.01)	<0.01
COD (4.0)	4.2
Coliform, Fecal	--
Cyanides, Total (0.01)	<0.01
Hardness, Total (1)	153
Nitrogen, Ammonia (0.10)	0.29
Nitrogen, Kjeldahl (0.10)	ND
Oil & Grease (0.5)	ND
TOC (0.5)	2.9
Phenols	--
Phosphorus, Total (0.02)	0.06
TDS (1.0)	176
TSS (1.0)	14.0

ND - Not detected, detection limit in ()
< - Below detection limit

(Continued)

Table 30 (Continued)

Result Units: ug/l

PARAMETER / SEI ID STATION NO.	4975-6 #1	4975-7 #2	4975-8 #3	4975-9 #4	4975-10 #5	4975-11 #6	4975-12 #7	4975-13 #8
2-Chlorophenol (5)	ND	ND	ND	ND	ND	ND	ND	ND
2-Nitrophenol (5)	ND	ND	ND	ND	ND	ND	ND	ND
Phenol (5)	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dimethylphenol (5)	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dichlorophenol (5)	ND	ND	ND	ND	ND	ND	ND	ND
2,4,6-Trichlophenol (5)	ND	ND	ND	ND	ND	ND	ND	ND
4-Chloro-3-methylphenol (5)	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dinitrophenol (10)	ND	ND	ND	ND	ND	ND	ND	ND
2-Methyl-4,6-dinitrophenol (10)	ND	ND	ND	ND	ND	ND	ND	ND
Pentachlorophenol (5)	ND	ND	ND	ND	ND	ND	ND	ND
4-Nitrophenol (5)	ND	ND	ND	ND	ND	ND	ND	ND

ND - Not detected, detection limit in ()
< - Below detection limit

(Continued)

Table 30 (Continued)

Result Units: ug/l

PARAMETER SEI ID STATION NO.	4975-14 #9
2-Chlorophenol (5)	ND
2-Nitrophenol (5)	ND
Phenol (5)	ND
2,4-Dimethylphenol (5)	ND
2,4-Dichlorophenol (5)	ND
2,4,6-Trichlophenol (5)	ND
4-Chloro-3-methylphenol (5)	ND
2,4-Dinitrophenol (10)	ND
2-Methyl-4,6-dinitro-phenol (10)	ND
Pentachlorophenol (5)	ND
4-Nitrophenol (5)	ND

ND - Not detected, detection limit in ()
< - Below detection limit

(Continued)

Table 30 (Continued)

Result Units: ug/l

PARAMETER / SEI STATION ID NO.	4975-6 #1	4975-7 #2	4975-8 #3	4975-9 #4	4975-10 #5	4975-11 #6	4975-12 #7	4975-13 #8
Acenephthene (4)	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene (2)	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene (1)	ND	ND	ND	ND	ND	ND	ND	ND
Benze(a)anthracene (2)	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(b)fluoranthene (2)	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(k)fluoranthene (2)	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene (4)	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(g,h,i)perylene (2)	ND	ND	ND	ND	ND	ND	ND	ND
Benzidine (10)	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-chloroethyl)ether (5)	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-chloroethoxy)methane (4)	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-ethylhexyl)phthalate (2)	ND	ND	ND	ND	ND	ND	360	15
Bis(2-chloroisopropyl) ether (5)	ND	ND	ND	ND	ND	ND	ND	ND
4-Bromophenyl phenyl ether (10)	ND	ND	ND	ND	ND	ND	ND	ND
Butyl benzyl phthalate (6)	ND	ND	ND	ND	ND	ND	ND	ND
2-Chloronaphthalene (4)	ND	ND	ND	ND	ND	ND	ND	ND
4-Chlorophenyl phenyl ether (10)	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene (2)	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzo(a,h)anthracene (6)	ND	ND	ND	ND	ND	ND	ND	ND
Di-n-butyl phthalate (1)	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene (10)	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene (5)	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene (5)	ND	ND	ND	ND	ND	ND	ND	ND
3,3'-Dichlorobenzidine (10)	ND	ND	ND	ND	ND	ND	ND	ND
Diethylphthalate (4)	ND	ND	ND	ND	ND	ND	ND	ND
Dimethylphthalate (4)	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dinitrotoluene (2)	ND	ND	ND	ND	ND	ND	ND	ND

(Continued)

Table 30 (Continued)

Result Units: ug/l

PARAMETER / SEI ID STATION NO.	4975-6 #1	4975-7 #2	4975-8 #3	4975-9 #4	4975-10 #5	4975-11 #6	4975-12 #7	4975-13 #8
2,6-Dinitrotoluene (10)	ND	ND	ND	ND	ND	ND	ND	ND
Dioctylphthalate (2)	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Diphenylhydrazine (10)	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene (3)	ND	ND	ND	ND	ND	ND	ND	ND
Fluorene (3)	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorobenzene (10)	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorobutadiene (10)	ND	ND	ND	ND	ND	ND	ND	ND
Hexachloroethane (10)	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorocyclopentadiene (10)	ND	ND	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene (5)	ND	ND	ND	ND	ND	ND	ND	ND
Isophorone (5)	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene (2)	ND	ND	ND	ND	ND	ND	ND	ND
Nitrobenzene (10)	ND	ND	ND	ND	ND	ND	ND	ND
n-Nitrosodimethylamine (10)	ND	ND	ND	ND	ND	ND	ND	ND
n-Nitrosodi-propylamine (10)	ND	ND	ND	ND	ND	ND	ND	ND
n-Nitrosodiphenylamine (10)	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene (1)	ND	ND	ND	ND	ND	ND	ND	ND
Pyrene (2)	ND	ND	ND	ND	ND	ND	ND	ND
2,3,7,8-Tetrachlorodibenzo-p-dioxin (10)	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene (10)	ND	ND	ND	ND	ND	ND	ND	ND

ND - Not detected, detection limit in ()
< - Below detection limit

(Continued)

Table 30 (Continued)

Result Units: ug/l

PARAMETER / SEI ID STATION NO.	4975-14 #9
Acenephthene (4)	ND
Acenaphthylene (2)	ND
Anthracene (1)	ND
Benze(a)anthracene (2)	ND
Benzo(b)fluoranthene (2)	ND
Benzo(k)fluoranthene (2)	ND
Benzo(a)pyrene (4)	ND
Benzo(g,h,i)perylene (2)	ND
Benzidine (10)	ND
Bis(2-chloroethyl)ether (5)	ND
Bis(2-chloroethoxy) methane (4)	ND
Bis(2-ethylhexyl) phthalate (2)	69
Bis(2-chloroisopropyl) ether (5)	ND
4-Bromophenyl phenyl ether (10)	ND
Butyl benzyl phthalate (6)	ND
2-Chloronaphthalene (4)	ND
4-Chlorophenyl phenyl ether (10)	ND
Chrysene (2)	ND
Dibenzo(a,h)anthracene (6)	ND
Di-n-butyl phthalate (1)	ND
1,3-Dichlorobenzene (10)	ND
1,4-Dichlorobenzene (5)	ND
1,2-Dichlorobenzene (5)	ND
3,3'-Dichlorobenzidine (10)	ND
Diethylphthalate (4)	ND
Dimethylphthalate (4)	ND

(Continued)

Table 30 (Continued)

Result Units: ug/l

PARAMETER / SEI ID STATION NO.	4975-14 #9
2,4-Dinitrotoluene (2)	ND
2,6-Dinitrotoluene (10)	ND
Dioctylphthalate (2)	ND
1,2-Diphenylhydrazine (10)	ND
Fluoranthene (3)	ND
Fluorene (3)	ND
Hexachlorobenzene (10)	ND
Hexachlorobutadiene (10)	ND
Hexachloroethane (10)	ND
Hexachlorocyclopentadiene (10)	ND
Indeno(1,2,3-cd)pyrene (5)	ND
Isophorone (5)	ND
Naphthalene (2)	ND
Nitrobenzene (10)	ND
n-Nitrosodimethylamine (10)	ND
n-Nitrosodi-propylamine (10)	ND
n-Nitrosodiphenylamine (10)	ND
Phenanthrene (1)	ND
Pyrene (2)	ND
2,3,7,8-Tetrachlorodibenzo-p-dioxin (10)	ND
1,2,4-Trichlorobenzene (10)	ND

ND - Not detected, detection limit in ()
< - Below detection limit

(Continued)

Table 30 (Continued)

Result Units: ug/l

PARAMETER / SEI ID STATION NO.	4975-6 #1	4975-7 #2	4975-8 #3	4975-9 #4	4975-10 #5	4975-11 #6	4975-12 #7	4975-13 #8
Aldrin (0.002)	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Chlordane (0.025)	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
4,4'-DDD (0.004)	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
4,4'-DDE (0.002)	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
4,4'-DDT (0.015)	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
Dieldrin (0.002)	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Endrin (0.003)	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Heptachlor (0.002)	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Heptachlor epoxide (0.002)	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Lindane (0.01)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Methoxychlor (0.5)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Mirex (0.005)	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Toxaphene (0.25)	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
PCB (0.05)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

ND - Not detected, detection limit in ()
< - Below detection limit

(Continued)

Table 30 (Continued)

Result Units: ug/l

PARAMETER	SEI ID STATION NO.	4975-14 #9
Aldrin (0.002)		<0.002
Chlordane (0.025)		<0.025
4,4'-DDD (0.004)		<0.004
4,4'-DDE (0.002)		<0.002
4,4'-DDT (0.015)		<0.015
Dieldrin (0.002)		<0.002
Endrin (0.003)		<0.003
Heptachlor (0.002)		<0.002
Heptachlor epoxide (0.002)		<0.002
Lindane (0.01)		<0.01
Methoxychlor (0.5)		<0.5
Mirex (0.005)		<0.005
Toxaphene (0.25)		<0.25
PCB (0.05)		<0.05

ND - Not detected, detection limit in ()

< - Below detection limit

(Continued)

Table 30 (Continued)

Result Units: ug/l

PARAMETER / SEI ID / STATION NO.	4975-6 #1	4975-7 #2	4975-8 #3	4975-9 #4	4975-10 #5	4975-11 #6	4975-12 #7	4975-13 #8
Acrolein (50)	ND	ND	ND	ND	ND	ND	ND	ND
Acrylonitrile (50)	ND	ND	ND	ND	ND	ND	ND	ND
Benzene (1)	ND	ND	ND	ND	ND	ND	ND	ND
Bromomethane (10)	ND	ND	ND	ND	ND	ND	ND	ND
Bromodichloromethane (2)	ND	ND	ND	ND	ND	ND	ND	ND
Bromoform (1)	ND	ND	ND	ND	ND	ND	ND	ND
Carbon tetrachloride (2)	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene (2)	ND	ND	ND	ND	ND	ND	ND	ND
Chloroethane (1)	ND	ND	ND	ND	ND	ND	ND	ND
2-Chloroethyl vinyl ether (4)	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform (1)	ND	ND	ND	ND	ND	ND	ND	ND
Chloromethane (10)	ND	ND	ND	ND	ND	ND	ND	ND
Dibromochloromethane (2)	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane (1)	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane (1)	ND	ND	ND	<1	ND	ND	<1	ND
1,1-Dichloroethene (1)	ND	ND	ND	ND	ND	ND	ND	ND
Trans-1,2-Dichloroethene (1)	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloropropane (1)	ND	ND	ND	ND	ND	ND	ND	ND
Cis-1,3-Dichloropropene (2)	ND	ND	ND	ND	ND	ND	ND	ND
Trans1,3-Dichloropropene (2)	ND	ND	ND	ND	ND	ND	ND	ND
Ethyl benzene (1)	ND	ND	ND	ND	ND	ND	ND	ND
Methylene chloride (1)	<1	<1	<1	<1	<1	<1	<1	<1
1,1,2,2-Tetrachloroethane (3)	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethene (1)	ND	ND	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane (1)	ND	ND	<1	ND	ND	<1	ND	ND
1,1,2-Trichloroethane (1)	ND	ND	ND	ND	ND	ND	ND	ND

(Continued)

Table 30 (Continued)

Result Units: ug/l

PARAMETER	SEI ID STATION NO.	4975-6 #1	4975-7 #2	4975-8 #3	4975-9 #4	4975-10 #5	4975-11 #6	4975-12 #7	4975-13 #8
Trichloroethane (1)		ND	ND	ND	ND	ND	ND	ND	ND
Trichlorofluoromethane (1)		ND	ND	ND	ND	ND	ND	ND	ND
Toluene (1)		ND	ND	ND	ND	ND	ND	ND	ND
Vinyl chloride (10)		ND	ND	ND	ND	ND	ND	ND	ND
Xylene (1)		ND	ND	ND	ND	ND	ND	ND	ND

ND - Not detected, detection limit in ()
< - Below detection limit

(Continued)

Table 30 (Continued)

Result Units: ug/l

PARAMETER SEI ID STATION NO.	4975-14 #9
Acrolein (50)	ND
Acrylonitrile (50)	ND
Benzene (1)	ND
Bromomethane (10)	ND
Bromodichloromethane (2)	ND
Bromoform (1)	ND
Carbon tetrachloride (2)	ND
Chlorobenzene (2)	ND
Chloroethane (1)	ND
2-Chloroethyl vinyl ether (4)	ND
Chloroform (1)	ND
Chloromethane (10)	ND
Dibromochloromethane (2)	ND
1,1-Dichloroethane (1)	ND
1,2-Dichloroethane (1)	ND
1,1-Dichloroethene (1)	ND
Trans-1,2-Dichloroethene (1)	ND
1,2-Dichloropropane (1)	ND
Cis-1,3-Dichloropropene (2)	ND
Trans1,3-Dichloropropene (2)	ND
Ethyl benzene (1)	ND
Methylene chloride (1)	ND
1,1,2,2-Tetrachloroethane (3)	ND
Tetrachloroethene (1)	ND
1,1,1-Trichloroethane (1)	ND
1,1,2-Trichloroethane (1)	ND

(Continued)

Table 30 (Concluded)

Result Units: ug/l

PARAMETER SEI ID STATION NO.	4975-14 #9
Trichloroethane (1)	ND
Trichlorofluoromethane (1)	ND
Toluene (1)	ND
Vinyl chloride (10)	ND
Xylene (1)	ND

ND - Not detected, detection limit in ()
< - Below detection limit

Table 31. Water Quality Data from GCR-IHC 3-4 Oct 84 (Source R12, Table 6) (see Figure 20)

[mg/L, milligram per liter; n.d., no data; °C, degree Celsius; µS/cm, microsiemens per centimeter at 25 °Celsius; µg/L, microgram per liter]

	Determined by meter			Determined by Winkler method		
Station ID	Average dissolved-oxygen concentration (mg/L)	Minimum dissolved-oxygen concentration (mg/L)	Maximum dissolved-oxygen concentration (mg/L)	Average dissolved-oxygen concentration (mg/L)	Minimum dissolved-oxygen concentration (mg/L)	Maximum dissolved-oxygen concentration (mg/L)
C1A	8.2	7.7	9.5	7.8	7.4	8.2
C3	7.4	6.2	8.3	8.0	7.8	8.6
C4	7.4	6.4	8.4	7.3	6.8	7.8
C5	6.7	6.4	7.4	6.0	4.0	7.0
C6	6.1	5.3	6.6	5.9	5.0	6.6
C12	5.7	4.8	6.2	5.7	5.0	6.4
GW1	6.5	6.3	7.2	8.1	8.0	8.4
GW1A	5.5	4.3	6.1	6.4	6.2	6.6
GW2	5.3	4.9	5.7	7.0	6.6	7.4
GW3	5.0	4.5	5.7	6.4	5.8	7.0
GW4	6.4	5.7	6.9	8.0	7.8	8.4
GW6	6.9	6.4	7.4	8.6	8.2	8.8
GW7	6.1	5.4	6.8	8.9	8.4	9.2
GW7A	6.8	6.3	7.1	8.3	7.8	8.6
GW10A	8.0	7.4	9.2	7.3	7.2	7.4
GW11A	9.4	8.4	11.9	8.4	8.0	8.8
GW12	10.3	9.7	11.8	9.1	9.0	9.2
GW13	9.3	8.7	10.0	9.0	8.8	9.2
ST14	4.7	3.8	5.2	4.4	4.2	4.6
ST17	7.5	5.2	11.5	6.1	6.0	6.2
GWTP	5.9	4.4	7.7	n.d.	n.d.	n.d.
VM1	n.d.	n.d.	n.d.	8.0	7.8	8.2
DP1	n.d.	n.d.	n.d.	7.4	7.2	7.6
DP2	n.d.	n.d.	n.d.	8.5	8.3	9.0
DP3	n.d.	n.d.	n.d.	7.6	7.4	8.0
HW1	n.d.	n.d.	n.d.	3.3	< .1	6.6
USSL1	n.d.	n.d.	n.d.	5.5	5.4	5.6
C7	6.6	4.4	7.6	6.3	4.4	7.6
C7A	5.8	4.8	7.0	5.7	4.6	6.6
C8	5.0	4.0	6.0	4.9	4.2	6.0
C9	1.5	.9	3.0	1.3	.8	1.8
C10	.9	.6	1.4	.6	.2	1.2
C11	.8	.6	1.0	.9	.8	1.2
ECWTP	5.7	4.7	7.1	n.d.	n.d.	n.d.
HWTP	7.2	n.d.	n.d.	n.d.	n.d.	n.d.

(Continued)

Table 31 (Continued)

Station ID	Average temper-ature (°C)	Minimum temper-ature (°C)	Maximum temper-ature (°C)	Average specific conductance (μS/cm)	Minimum specific conductance (μS/cm)	Maximum specific conductance (μS/cm)
C1A	19.1	17.7	19.7	367	349	420
C3	18.3	16.4	19.5	359	343	380
C4	19.5	18.0	20.7	421	385	480
C5	19.2	17.9	20.7	429	384	478
C6	19.8	18.0	21.5	n.d.	n.d.	n.d.
C12	18.9	17.3	20.2	498	465	579
GW1	21.0	20.0	23.0	356	350	360
GW1A	32.0	28.0	35.0	363	330	420
GW2	27.6	25.0	30.0	420	340	550
GW3	22.0	21.0	23.0	372	340	420
GW4	17.8	17.0	18.0	358	340	380
GW6	17.2	16.0	19.0	359	340	390
GW7	23.2	16.0	28.0	335	320	360
GW7A	16.6	15.0	20.0	345	340	350
GW10A	20.7	20.0	22.0	341	300	380
GW11A	19.8	19.0	21.0	336	320	390
GW12	15.8	15.0	17.0	323	300	400
GW13	16.4	16.0	17.0	285	240	350
ST14	27.8	27.0	28.0	656	530	740
ST17	24.0	23.0	25.0	735	600	800
GWTP	18.8	17.0	20.0	n.d.	n.d.	n.d.
VM1	17.8	16.0	20.0	n.d.	n.d.	n.d.
DP1	26.3	25.0	28.0	n.d.	n.d.	n.d.
DP2	24.3	23.5	25.0	n.d.	n.d.	n.d.
DP3	29.6	23.5	31.0	n.d.	n.d.	n.d.
HW1	23.7	23.3	24.4	n.d.	n.d.	n.d.
USSL1	23.0	23.0	24.0	n.d.	n.d.	n.d.
C7	17.2	15.0	19.0	1,630	480	2,100
C7A	18.0	15.0	20.0	1,610	1,295	1,950
C8	20.1	18.2	21.0	1,180	1,000	1,320
C9	19.8	18.0	21.0	n.d.	650	n.d.
C10	19.0	17.0	20.3	n.d.	n.d.	n.d.
C11	18.6	16.8	21.1	1,150	1,010	1,290
ECWTP	18.2	17.5	19.0	n.d.	n.d.	n.d.
HWTP	17.8	16.0	21.0	n.d.	n.d.	n.d.

(Continued)

Table 31 (Continued)

Station ID	Average pH (standard units)	Minimum pH (standard units)	Maximum pH (standard units)	Suspended solids (mg/L)	Dissolved solids (mg/L)	Chloride (mg/L)	Fluoride (mg/L)	Sulfate (mg/L)	Hardness as $CaCO_3$ (mg/L)
C1A	7.6	7.3	7.8	10	203	25	0.2	33	110
C3	7.9	7.6	8.1	4	186	18	.3	31	110
C4	6.6	6.1	6.9	6	246	43	.3	38	140
C5	7.2	6.8	7.4	< 1	326	44	.4	40	140
C6	n.d.	n.d.	n.d.	3	306	44	.4	49	140
C12	7.3	7.3	7.5	4	288	52	.5	52	150
GW1A	7.9	7.7	8.2	3	173	13	.2	26	110
GW2	8.1	7.8	8.2	5	254	63	.1	29	130
GW3	7.7	7.4	8.0	4	162	17	.3	26	110
GW4	7.6	7.3	8.1	5	174	15	.2	26	110
GW6	7.7	7.4	8.0	2	168	12	.2	26	130
GW7	7.4	7.1	8.0	2	144	11	.2	22	120
GW7A	7.7	7.4	8.0	2	197	24	1.3	40	130
GW10A	8.1	7.9	8.3	4	167	11	.1	24	94
GW11A	8.3	8.1	8.6	2	193	21	.9	36	120
GW12	7.3	7.1	7.8	3	235	13	.1	36	140
GW13	7.4	7.0	7.6	2	162	11	.1	24	130
ST14	6.8	6.6	7.9	12	399	65	.3	120	250
ST17	6.6	6.4	6.8	2	523	190	.2	47	280
GWTP	7.1	7.0	7.5	4	480	84	.8	28	190
VM1	8.6	8.4	8.9	2	378	124	1.1	32	120
DP1	n.d.	n.d.	n.d.	6	284	44	.4	63	180
DP2	7.6	7.4	8.0	4	1,240	220	1.1	190	120
DP3	7.5	7.5	7.6	4	9,100	32	.7	5,900	320
HW1	n.d.	n.d.	n.d.	3	166	11	.9	26	110
USSL1	6.7	6.7	7.2	12	712	63	4.7	320	360
C7	7.6	7.5	8.2	12	938	329	2.3	154	200
C7A	n.d.	n.d.	n.d.	11	1,000	335	2.3	162	220
C8	7.1	6.8	7.2	14	684	160	1.3	116	200
C9	7.5	7.4	7.7	16	660	153	1.2	114	220
C10	n.d.	n.d.	n.d.	16	661	155	1.3	120	190
C11	7.1	6.9	7.2	16	674	160	1.2	120	140
GW1	7.8	7.7	7.9	4	184	17	.1	28	30
ECWTP	7.1	6.9	7.2	7	1,080	438	3.1	190	220
HWTP	n.d.	n.d.	n.d.	3	593	120	1.1	104	210

(Continued)

Table 31 (Continued)

Station ID	Five day biochemical-oxygen demand (mg/L)	Total biochemical-oxygen demand (mg/L)	Carbonaceous biochemical-oxygen demand (mg/L)	Filtered biochemical-oxygen demand (mg/L)	Total phenols (µg/L)	Total cyanide (mg/L)
C1A	3.8	12.0	5.5	n.d.	17	0.05
C3	1.8	6.5	3.0	n.d.	2	.02
C4	2.6	10.0	6.9	n.d.	34	.01
C5	3.7	11.0	7.7	n.d.	20	.01
C6	2.8	10.0	6.3	n.d.	2	< .01
C12	3.2	11.0	7.4	n.d.	27	< .01
GW1	2.0	6.5	4.0	n.d.	< 1	.04
GW1A	1.2	4.5	.5	n.d.	14	.02
GW2	2.4	13.0	5.6	n.d.	64	< .01
GW3	3.3	7.0	4.3	n.d.	13	.05
GW4	1.0	3.0	2.6	n.d.	< 1	< .01
GW6	1.5	5.0	2.7	n.d.	17	< .01
GW7	1.8	4.0	3.6	n.d.	< 1	< .01
GW7A	1.4	3.0	2.3	n.d.	52	.06
GW10A	2.1	13.0	7.4	n.d.	1	< .01
GW11A	3.0	12.0	7.8	n.d.	< 1	.05
GW12	1.0	3.0	2.5	n.d.	< 1	< .01
GW13	1.0	3.0	2.8	n.d.	< 1	< .01
ST14	1.5	7.0	4.5	n.d.	< 1	< .01
ST17	12.0	31	30	n.d.	67	< .01
GWTP	4.0	14.0	11.4	n.d.	2	< .01
VM1	1.0	4.0	3.7	n.d.	< 1	< .01
DP1	2.1	12.0	5.9	n.d.	16	.01
DP2	1.0	25.0	19.0	n.d.	< 1	< .01
DP3	1.2	4.0	3.4	n.d.	5	< .01
HW1	1.0	4.0	3.1	n.d.	n.d.	< .01
USSL1	1.0	7.0	3.1	n.d.	< 1	< .01
C7	2.5	27	16.	n.d.	8	.17
C7A	4.2	31	17.	n.d.	11	.04
C8	15.0	48	30	36	7	.02
C9	13.0	50	30	41	2	.02
C10	12.0	49	28	39	4	.02
C11	11.5	49	27	n.d.	3	.01
ECWTP	13.0	24	14.0	n.d.	2	.26
HWTP	4.5	36	21	n.d.	1	< .01

(Continued)

Table 31 (Continued)

Station ID	Total organic nitrogen (mg/L as N)	Total ammonia (mg/L as N)	Total nitrite (mg/L as N)	Total nitrate (mg/L as N)	Total ortho-phosphorus (mg/L as P)	Total phosphorus (mg/L)
C1A	0.5	1.50	0.05	0.21	0.02	0.02
C3	.1	.80	.06	.21	.02	.03
C4	.3	.71	.08	1.32	.02	.05
C5	.2	.77	.09	1.51	.04	.13
C6	.5	.85	.10	1.40	.03	.04
C12	.6	.82	.13	1.57	.04	.06
GW1	.1	.58	.02	.21	.03	.04
GW1A	< .1	.93	.03	.26	< .01	< .01
GW2	.2	1.70	.03	.26	.01	< .01
GW3	.4	.63	.03	.21	.02	< .01
GW4	.2	.09	.03	.26	< .01	< .01
GW6	.1	.53	.03	.17	< .01	< .01
GW7	.2	.09	.01	.18	.02	.01
GW7A	.2	.17	.01	.14	.01	.02
GW10A	.1	1.30	.06	.21	< .01	.01
GW11A	< .1	.96	.05	.20	< .01	< .01
GW12	.1	.12	.01	.23	.02	< .01
GW13	.1	.05	.02	.26	< .01	< .01
ST14	< .1	.57	.02	.38	.01	< .01
ST17	.4	.22	.18	.11	.02	.03
GWTP	1.5	.61	.07	9.03	.20	.35
VM1	.2	.06	.36	.21	.09	.09
DP1	.2	1.40	.12	1.48	.03	.06
DP2	81.7	1.30	.01	.17	< .01	< .01
DP3	.6	.13	.01	.09	< .01	< .01
HW1	.1	.21	.02	.48	< .01	< .01
USSL1	.4	.91	.08	1.12	< .01	.04
C7	1.6	2.60	1.00	8.10	.05	.18
C7A	1.7	3.20	.98	8.12	.07	.23
C8	2.5	4.10	.43	3.07	.25	.54
C9	2.4	4.70	.37	2.13	.30	.62
C10	2.6	4.90	.34	1.96	.29	.58
C11	2.5	5.00	.37	2.13	.29	.44
ECWTP	1.9	2.40	1.80	10.20	.28	.57
HWTP	1.7	3.50	.18	1.52	.28	.35

(Continued)

Table 31 (Concluded)

Station ID	Total chromium (µg/L)	Total hexavalent chromium (µg/L)	Total copper (µg/L)	Total iron (µg/L)	Total lead (µg/L)	Total mercury (µg/L)	Total nickel (µg/L)	Total zinc (µg/L)
C1A	3	< 1	2	1,500	7	0.2	4	30
C3	2	< 1	4	810	6	.2	8	40
C4	2	< 1	1	1,000	4	.2	6	30
C5	2	< 1	8	3,600	42	.2	9	100
C6	2	< 1	3	740	5	.3	7	40
C12	< 1	< 1	3	1,200	6	.2	8	50
GW1	< 1	< 1	< 1	380	1	.5	5	20
GW1A	< 1	< 1	4	310	< 1	.7	4	30
GW2	< 1	< 1	1	360	< 1	2.5	10	20
GW3	2	< 1	< 1	410	< 1	.3	7	20
GW4	< 1	< 1	< 1	540	20	.3	5	20
GW6	1	< 1	< 1	250	< 1	.5	5	30
GW7	< 1	< 1	< 1	350	< 1	.3	7	40
GW7A	< 1	< 1	3	860	4	1.0	5	20
GW10A	2	< 1	1	470	< 1	.2	6	20
GW11A	1	< 1	< 1	760	3	1.0	7	30
GW12	1	< 1	< 1	490	1	.7	4	20
GW13	2	< 1	< 1	210	1	.4	5	20
ST14	1	< 1	1	6,000	3	1.1	7	30
ST17	1	< 1	< 1	1,100	< 1	.9	8	30
GWTP	n.d.	n.d.	9	450	1	.4	11	40
VM1	3	< 1	4	190	5	.6	5	20
DP1	1	< 1	1	1,700	15	.3	6	410
DP2	8	< 1	5	1,200	10	.2	12	40
DP3	7	< 1	7	1,000	28	< .1	8	90
HW1	5	< 1	2	290	2	.2	8	20
USSL1	< 1	< 1	61	2,600	n.d.	.3	24	380
C7	8	< 1	12	1,900	16	.3	13	100
C7A	4	< 1	6	1,200	14	.6	14	80
C8	4	< 1	7	1,200	12	.6	13	50
C9	3	< 1	2	1,100	15	.6	13	50
C10	< 1	< 1	7	1,200	14	.6	14	50
C11	< 1	< 1	8	1,400	18	.5	13	50
ECWTP	1	< 1	3	700	8	1.3	12	60
HWTP	1	< 1	< 1	330	< 1	.5	11	20

(Sheet 6 of 6)

Table 32. Chemical-Mass Discharge for Sampling Stations in GCR-IHC, 3-4 October 84 (Source R12, Table 9) (see Figure 20)

[Results in pounds per day; loads shown as less than (<) are based on estimate of streamflow and detection limit of given constituent or property; numbers are rounded to 3 or less significant figures; n.d., no data]

Station ID	Suspended solids	Dissolved solids	Chloride	Sulfate	Fluoride	Hardness
C1A	6,850	139,000	17,100	22,600	137	75,300
C3	7,980	371,000	35,900	61,800	598	219,000
C4	15,700	643,000	112,000	99,300	784	366,000
C5	< 2,610	852,000	115,000	105,000	1,050	366,000
C6	8,000	816,000	117,000	131,000	1,070	374,000
C12	10,800	776,000	140,000	140,000	1,350	404,000
GW1	940	43,200	4,000	6,580	23.5	7,050
GW1A	21	1,210	91	182	1.4	771
GW2	334	17,000	4,210	1,940	6.7	8,690
GW3	138	5,590	586	897	10.3	3,800
GW4	78	2,720	234	406	3.1	1,720
GW6	602	50,500	3,610	7,820	60.2	39,100
GW7	622	44,800	3,420	6,840	62.2	37,300
GW7A	1,260	125,000	15,200	25,300	822	82,200
GW10A	166	6,930	457	996	4.2	3,900
GW11A	503	48,600	5,290	9,060	227	30,200
GW12	176	13,800	764	2,120	5.9	8,230
GW13	42	3,410	231	505	2.1	2,730
ST14	168	5,590	911	1,680	4.2	3,500
ST17	364	95,300	34,600	8,560	36.4	51,010
GWTP	1,110	133,000	23,300	7,760	222	52,600
VM1	2	306	100	26	.9	97
DP1	226	10,700	1,660	2,380	15.1	6,790
DP2	39	12,000	2,130	1,840	10.7	1,160
DP3	24	n.d.	190	35,000	4.2	1,900
HW1	1	54	4	8	.3	36
USSL1	1	38	3	17	.3	19
C7	168	13,100	4,610	2,160	32.2	2,800
C7A	860	78,200	26,200	12,700	180	17,200
C8	3,850	188,000	44,000	31,900	357	55,000
C9	4,400	181,000	42,100	31,300	330	60,500
C10	4,400	182,000	42,600	33,000	357	52,200
C11	4,400	185,000	44,000	33,000	330	38,500
ECWTP	751	116,000	47,000	20,400	333	23,600
HWTP	690	136,000	27,600	24,000	253	48,300

(Continued)

Table 32 (Continued)

Station ID	Total biochemical-oxygen demand	Carbonaceous biochemical-oxygen demand	Total phenol	Total cyanide
C1A	8,210	3,770	11.6	34.2
C3	13,000	6,060	4.00	39.9
C4	26,100	18,100	88.9	26.1
C5	28,800	20,000	52.3	26.1
C6	26,700	16,900	5.3	< 26.7
C12	29,600	20,100	72.8	< 26.9
GW1	1,530	937	< .24	9.4
GW1A	32	3	.10	.1
GW2	869	377	4.28	< .7
GW3	241	147	.45	1.7
GW4	47	41	< .02	< .2
GW6	1,500	814	5.11	< 3.0
GW7	1,240	1,120	< .31	< 3.1
GW7A	1,900	1,430	32.9	37.9
GW10A	540	306	.04	< .4
GW11A	3,020	1,970	< .25	12.6
GW12	176	146	< .06	< .6
GW13	63	59	< .02	< .2
ST14	98	64	< .01	< .1
ST17	5,650	5,470	12.2	< 1.8
GWTP	3,880	3,150	.55	< 2.8
VM1	3	3	< .01	< .1
DP1	453	224	.60	.4
DP2	243	188	< .01	< .1
DP3	24	20	.03	< .1
HW1	1	1	n.d.	< .1
USSL1	< 1	< 1	< .01	< .1
C7	378	221	.11	2.4
C7A	2,420	1,340	.86	3.1
C8	13,200	8,320	1.92	5.5
C9	13,700	8,150	.55	5.5
C10	13,500	7,640	1.10	5.5
C11	13,500	7,520	.82	2.7
ECWTP	2,600	1,460	.21	27.9
HWTP	8,300	4,800	.23	< 2.3

(Continued)

Table 32 (Continued)

Station ID	Total organic nitrogen	Total ammonia	Total nitrite	Total nitrate	Total phosphorus	Total ortho-phosphorus
C1A	342	1,030	34.2	144	13.7	13.7
C3	199	1,600	120	419	59.8	39.9
C4	758	1,860	209	3,450	131	52.3
C5	601	2,010	235	3,950	340	105
C6	1,470	2,270	267	3,740	107	80.0
C12	1,560	2,210	350	4,230	162	108
GW1	28.2	136	4.7	49.4	9.4	7.1
GW1A	< .9	6.5	.2	1.8	< .1	< .1
GW2	13.4	114	2.0	17.4	< .7	.7
GW3	12.8	21.7	1.0	7.2	< .3	.7
GW4	3.3	1.4	.5	4.1	< .2	< .2
GW6	21.1	159	9.0	51.1	< 3.0	< 3.0
GW7	65.3	28.0	3.1	56.0	3.1	6.2
GW7A	145	108	6.3	88.5	12.6	6.3
GW10A	4.2	54.0	2.5	8.7	.4	< .4
GW11A	10.1	242	12.6	50.3	< 2.5	< 2.5
GW12	4.7	7.1	.6	13.5	< .6	1.2
GW13	3.2	1.1	.4	5.5	< .2	< .2
ST14	.4	8.0	.3	5.3	< .1	.1
ST17	69.2	40.1	32.8	20.0	5.5	3.6
GWTP	413	169	19.4	2,500	97.0	55.4
VM1	.2	< .1	.3	0.2	.1	.1
DP1	7.5	52.8	4.5	55.8	2.3	1.1
DP2	793	12.6	.1	1.6	< .1	< .1
DP3	3.4	.8	.1	0.5	< .1	< .1
HW1	< .1	.1	< .1	0.2	< .1	< .1
USSL1	< .1	< .1	< .1	0.1	< .1	< .1
C7	22.4	36.4	14.0	114	2.5	.7
C7A	133	250	76.6	635	18.0	5.5
C8	687	1,130	118	844	148	68.7
C9	660	1,290	102	586	170	82.5
C10	715	1,350	93.5	539	159	79.7
C11	687	1,375	102	586	121	79.7
ECWTP	204	257	193	1,090	61.1	30.0
HWTP	391	806	41.4	350	80.5	64.5

(Continued)

Table 32 (Concluded)

Station ID	Total chromium	Total copper	Total iron	Total lead	Total mercury	Total nickel	Total zinc
C1A	2.05	1.37	1,030	4.79	.14	2.74	20.5
C3	3.99	7.98	1,620	12.0	.40	16.0	79.8
C4	5.23	5.23	2,610	10.5	.52	15.7	78.4
C5	5.23	20.9	9,410	110	.52	23.5	261
C6	5.34	8.00	1,970	13.3	.80	18.7	107
C12	< 2.69	8.08	3,230	16.2	.54	21.6	135
GW1	< .24	< .24	89.3	.24	.12	1.18	4.70
GW1A	< .01	.03	2.2	< .01	< .01	.03	.21
GW2	< .07	.07	24.1	< .07	.17	.67	1.34
GW3	.07	< .03	14.1	< .03	.01	.24	.69
GW4	< .02	< .02	8.4	.31	< .01	.08	.31
GW6	.30	< .30	75.2	< .30	.15	1.50	9.02
GW7	< .31	< .31	109	< .31	.09	2.18	12.4
GW7A	< .63	1.90	544	2.53	.63	3.16	12.6
GW10A	.08	.04	19.5	< .04	.01	.25	.83
GW11A	.25	< .25	191	.76	.25	1.76	7.55
GW12	.06	< .06	28.8	.06	.04	.24	1.18
GW13	.04	< .02	4.4	.02	.01	.11	.42
ST14	.01	.01	84.1	.04	.02	.10	.42
ST17	.18	< .18	200	< .18	.16	1.46	5.47
GWTP	n.d.	2.49	125	.28	.11	3.05	11.1
VM1	< .01	< .01	.2	< .01	< .01	< .01	.02
DP1	.04	.04	64.1	.57	.01	.23	15.5
DP2	.08	.05	11.6	.10	< .01	.12	.39
DP3	.04	.04	5.9	.17	< .01	.05	.53
HW1	< .01	< .01	.1	< .01	< .01	< .01	.01
USSL1	< .01	< .01	.1	n.d.	< .01	< .01	.02
C7	.11	.17	26.6	.22	< .01	.18	1.40
C7A	.31	.47	93.8	1.09	.05	1.09	6.25
C8	1.10	1.92	330	3.30	.16	3.57	13.7
C9	.82	.55	302	4.12	.16	3.57	13.7
C10	< .27	1.92	330	3.85	.16	3.85	13.7
C11	< .27	2.20	385	4.95	.14	3.57	13.7
ECWTP	.11	.32	75.1	.86	.14	1.29	6.44
HWTP	.23	< .23	75.9	< .23	.11	2.53	4.61

Table 33. Exceedance of Water Quality Standards, Grand Calumet River, 3-4 Oct 84 (Source R12, Table 8) (see Figure 20)

[Based on Indiana Stream Pollution Control Board water-quality standards listed in table 5 in effect at time of survey; n.d., no data]

Constituent	Percent of stations where standard was exceeded	
	East Branch	West Branch
pH	0	0
Dissolved oxygen	0	50
Temperature	0	0
Ammonia (total)	0	100
Chloride	0	100
Cyanide	0	17
Dissolved solids	0	100
Fluoride	0	33
Phosphorus (total)	17	100
Sulfate	0	0
Chromium (total)	0	0
Iron (dissolved)	n.d.	n.d.
Lead (total)	0	0
Mercury (total)	0	67
PCB's (total)	n.d.	n.d.
Phenol	67	17

Table 34. Selected Water Quality Parameters and Concentrations from Indiana Harbor and Canal (Source R42, Table D7)

Parameter	Units	ISBH 1983[a]	USEPA 1981[b]	Polls and Dennison (1984)[c]	State Water Quality Standards
Dissolved Solids	mg/l	-	247.2 mg/l	267.3	
Suspended Solids	mg/l	10.9 mg/l	18.2 mg/l	9.5	
BOD	mg/l	2.88 mg/l	11.8 mg/l	3.8	
COD	mg/l	16.0 mg/l	37.7 mg/l	20.5	
Ammonia-N	mg/l	1.300 mg/l	1.661 mg/l	0.636	
NO_2+NO_3-N	mg/l	0.863 mg/l	0.578 mg/l	-	
Total Kieldahl Nitrogen	mg/l	-	2.25 mg/l	3.79	
Cyanide	ug/l	126.3	110.3	12.3	10.0
Phenolics	ug/l	5.4	7.7	14.8	1.0
Total Phosphorus	mg/l	0.633	0.108	<0.1	0.03
Oil and Grease	mg/l	3.92	6.8	2.6	
Fecal Coliform	#colonies/100 ml	871.0	-	-	
Total Dissolved Oxygen	mg/l	7.11	-	-	7.0
Arsenic	ug/l	1.67	15.7	1.0	50.0
Cadmium	ug/l	2.0	<2	0.33	1.00
Chromium (hex)	ug/l	10.0	-	<2	
Copper	ug/l	5.2	9.0	17.6	
Iron	ug/l	1215.5	1445.0	554.9	0.15
Lead	ug/l	10.7	<30	5.0	50.0
Mangenese	ug/l	67.8	60.0	122	
Mercury	ug/l	0.107	0.17	0.086	0.05
Nickel	ug/l	<10	<30	-	
Zinc	ug/l	52.6	81.7	0.0757	

a denotes monthly averages from three sampling sites during 1983 (ISBH 1983).
b denotes averages from six samples collected during 1980 (USEPA 1981).
c denotes averages from fourteen samples collected during 1983 (Polls and Dennison 1984).

Table 35. Concentrations of Total PCBs Found in Hexane Bags Used to Monitor Water Quality (Source R1, Table 1) (see Figure 21)

Sample	Hour	Amt DCB pg/ul)	PCBs (ppb)	MDL (ppb)
Forks 1	7	3.12	62.40	10.00
Forks 2	7	1.57	31.40	10.00
Forks 3	7	0.50	10.00	10.00
Forks 1	48	0.83	16.60	10.00
Forks 2	48	0.52	10.40	10.00
Forks 3	48	0.46	9.20	10.00
Forks 1	168	0.00	0.00	10.00
Forks 2	168	3.32	66.40	10.00
Forks 3	168	0.15	3.00	10.00
Forks 1	336	1.59	31.80	10.00
Forks 2	336	0.95	19.00	10.00
Forks 3	336	0.71	14.20	10.00
Forks 1	720	2.25	45.00	10.00
Forks 2	720	4.11	82.20	10.00
Forks 3	720	2.07	41.40	10.00
Bag Blank 1	0	0.00	0.00	10.00
Bag Blank 2	0	0.00	0.00	10.00
Blank 1	0	0.02	0.40	10.00
Blank 2	0	0.08	1.60	10.00

MDL = Method Detection Limit
Limit of Quantitation = 1 pg DCB
Limit of Detection = 500 fg
Percent recovery of perchlorination: 95%

Table 36. Industrial Point Source Loadings, ISBH 1984 Survey (Source R13, Table 2-8) (see Figure 29)

Industry	Flow	BOD	Ammonia	Phosphorus	Chlorides	TDS	Sulfates	Cyanides	Iron	Phenols	Lead
Citgo	--	--	--	--	--	--	--	--	--	--	--
Dupont	4.70	157	--	0.2	1,137	52,486	33,935	--	--	--	--
Inland Steel	592	23,704	1,977	147	85,322	919,578	135,306	39	352	31	0
J & L Steel	154	5,195	484	47	51,878	335,274	50,059	32	0	9	--
U.S.S. Lead	0.06	4	--	--	95	403	260	--	--	--	--
U.S. Steel	309	10,710	827	107	58,221	525,617	66,572	3	637	6	0
Vulcan Materials	0.12	14	--	--	950	1,661	42	--	--	--	--
Industrial Disposal	1.00	127	--	3	9,365	23,567	2,977	--	--	--	--
American Steel	0.13	2	--	--	39	358	69	--	1	--	--
Blaw Knox	0.04	4	--	--	24	1140	33	--	--	--	--
Explorer Pipeline	--	--	--	--	--	--	--	--	--	--	--

Notes: All water quality parameters shown in lbs/day. (mg/l = lbs/day $\times \frac{1}{8.34} \times \frac{1}{\text{Flow}}$)

-- indicates parameter not measured.
0 indicates parameter measured to be zero.
Flow is in millions of gallons per day.

Table 37. Combined Sewer Overflows to the Grand Calumet River-Locations and Characteristics (Source R13, Table 2-12) (see Figure 28)

Map CSO Number	Mile-Segment[1] [Cross St.]	Sanitary District	Est. Annual Overflow Vol. [References below]
1	12.6-E.Br.	Gary	1.25 bg/year (USEPA, 1983)
2	12.3-E.Br. [Virginia St.]	Gary	0.59 bg/year (USEPA, 1983)
3	11.2-E.Br. [Hwy 90]	Gary	0.09 bg/year (USEPA, 1983)
4	11.0-E.Br. [Buchanan St.]	Gary	0.27 bg/year (USEPA, 1983)
5	10.0-E. Br. [Bridge St.]	Gary	0.43 bg/year (USEPA, 1983)
6	9.4-E.Br. [Hwy 90]	Gary	0.89 bg/year (USEPA, 1983)
7	7.6-E.Br.	Gary	0.75 bg/year (USEPA, 1983)
8	6.5-E.Br. [Cline Ave.]	E. Chicago	0.49 bg/year (USEPA, 1983)
9	4.7-E.Br. [Kennedy Ave.]	Hammond	1.80 bg/year (USEPA, 1983)
10[2]	4.6-W.Br. [Indianapolis Boulevard]	E. Chicago	2.93 bg/year (USEPA, 1983)
11	6.0-W.Br. [Columbia Ave.]	Hammond (pump sta.)	1.22 bg/year (USEPA, 1983)
12	6.0-W.Br. [Columbia Ave.]	Hammond	0.09 bg/year (USEPA, 1983)
13	1.7-S.Ca. [Turning basin]	E. Chicago	0.23 bg/year (N/A)

[1] River miles, as delineated in ISHB 1984. Name of Segment or Reach: E.Br. = East Branch; W.Br. = West Branch; M.St. = Main Stem; S.CA. = Ship Canal, from Lake George Branch to Harbor.
[2] Assumed point of entry for Magoun Avenue Pumping Station CSO.

(Continued)

Table 37 (Concluded)

Map CSO Number	Mile-Segment [Cross St.]	Sanitary District	Est. Annual Overflow Vol. [References below]
14	1.7-S.Ca. [Opposite turning basin]	E. Chicago	(3)

(3)Although listed as a CSO, this outfall is a storm sewer only. This outfall has been included because it discharges significant volumes of oily wastes which infiltrate into the storm sewer from contaminated groundwater and soils at the Energy Cooperative, Inc., site.

References: Williams, G. G. East Chicago Lab and Field data, Volume 3. Howard, Needles, Tammen, and Bergendoff, September 1981. As cited in Combined Sewer Overflow Loading Inventory for Great Lakes Basin, Final Report. March 1983. Prepared for USEPA Great Lakes National Program Office, Chicago, by GCS Corporation.

Howard, Needles, Tammen, and Bergendoff Company for Bessozzi, Carpenter, and Ignelzi, Inc., of Hammond, IN. East Chicago Combined Sewer Overflow Water Quality Impact Analysis. Volume I: Technical Report. January 1982.

Table 38. Chemical and Physical Properties of 19 Point Source Dischargers in the Grand Calumet River Basin During July and August 1986 (Source R30, Table 2)

Outfall	pH	Hardness (mg/L $CaCO_3$)	Alkalinity (mg/L $CaCO_3$)	Specific Conductance (µS)
East Chicago	7.78	247-259	149-160	1464
East Chicago[a]	8.10	133-138	253-265	1575
Gary STP	8.10	227-255	149-159	728
Hammond STP	7.90	200-256	235-249	1119
U.S. X				
002	8.22	115-147	112-154	279
007	8.32	128-142	112-126	278
010	7.81	137-145	112-124	378
018	8.04	117-143	100-106	252
020	7.39	125-142	100-120	282
030	8.29	132-147	113-126	330
034	7.80	211-224	98-109	535
E.I. DuPont de Nemours				
003	7.42	510-540	30-40	8670
003[a]	7.22	392-400	24-30	8480
LTV Steel				
009	8.05	133-150	101-109	355
010	7.98	154-175	110-124	434
011	8.39	116-139	60-64	441
Inland Steel Co.				
002	8.17	90-147	96-117	286
008	8.10	104-138	104-119	301
008a	8.24	101-108	138-145	339
011	8.66	117-156	105-129	300
012	8.30	131-142	103-114	329
014	8.26	151-189	88-103	458
014[a]	7.87	148-164	88-96	467

a - water chemistry for definitive sample.

Table 39. Industrial Point Source Loadings 1984 (Source R20, Table 3) (see Figure 29)

Industry	Flow mgd	BOD	Ammonia	Phosphorus	Chlorides	TDS	Sulfates	Cyanides	Iron	Phenols	Lead
Citgo	-†	-	-	-	-	-	-	-	-	-	-
duPont	4.70	157	-	0.2	1,137	52,486	33,935	-	-	-	-
Inland Steel	592	23,704	1,977	147	85,322	919,578	135,306	39	352	31	0††
J & L Steel	154	5,195	484	47	51,878	335,274	50,059	32	0	9	-
U.S.S. Lead	0.06	4	-	-	95	403	260	-	-	-	-
U.S. Steel	309	10,710	827	107	58,221	525,617	66,572	3	637	6	0
Vulcan Materials	0.12	14	-	-	950	1,661	42	-	-	-	-
Industrial disposal	1.00	127	-	3	9,365	23,567	2,977	-	-	-	-
American Steel	0.13	2	-	-	39	358	69	-	1	-	-
Blaw Knox	0.04	4	-	-	24	140	33	-	-	-	-
Explorer Pipeline	-	-	-	-	-	-	-	-	-	-	-
Totals	1,061	39,917	3,288	301	207,031	1,859,084	289,253	74	989	46	0

* USEPA (1985).

** All water quality parameters are shown in pounds per day $\left(mg/\ell = lb/day \times \frac{1}{8.34} \times \frac{1}{Flow}\right)$.

† - indicates parameter not measured.

†† 0 indicates parameter measured to be zero.

Table 40. Industrial Discharges to GCR-IHC Dry Weather, 1983 (Source R20, Table 1) (see Figure 29)

Industry	Outfall No.	Description
U.S. Steel	002	Tube operation recycle blow down, noncontact water from coke plant
	005	Noncontact cooling water from coke plant
	007	Noncontact water from coke plant, miscellaneous
	010	Noncontact water from coke plant
	015	Noncontact water from #3 sinter plant
	018	Noncontact water from energy division
	020	Noncontact water from #1 basic oxygen process (BOP) shop
	028	Primary bar plate mills and BOP shops
	030	Primary bar plate mills and BOP shops
	032	Noncontact water from bar mills
	033	Noncontact cooling water from atmospheric gas plant and miscellaneous finishing operations
	034	Process water from terminal treatment plant and 84-in. hot strip mill recycle system blow down. Noncontact cooling from miscellaneous finishing operations
Industrial disposal	001	--
Vulcan materials	001	--
E.I. duPont	001	Process and noncontact cooling from chemical production
	002	Process and noncontact cooling from chemical production
	003	Process and noncontact cooling from chemical production
Harbison-Walker	001	--
U.S.S. Lead	001	Noncontact cooling water from blast furnace and casting mold
Blaw-Knox	001	--
	004	--
American Steel	001	Process and cooling waters from foundry
J & L Steel	001	Process and cooling from flat roll operations

(Continued)

* After HydroQual (1984).

(Continued)

Table 40 (Concluded)

Industry	Outfall No.	Description
J & L Steel	002	Cooling water from cold rolling and finishing
	009	Powerhouse and sinter plant cooling water
	010	Powerhouse and blast furnace cooling water
	011	Process and cooling water from steel plant operations
Inland Steel	001	Process and cooling water from electric furnace steel shop and bar mill
	002	Process water, cooling water, and noncontact water from numerous operations
	003	Process and noncontact cooling water from numerous operations
	005	Process and noncontact cooling water from bar mill
	007	Noncontact cooling from blast furnaces
	008	Noncontact condenser cooling water from powerhouse
	011	Noncontact cooling from blast furnaces, noncontact from sinter plant and powerhouse
	012	Blast furnaces blow down, cooling water from coke plant, and treated sanitary water
	014	Process water from numerous operations
	015	Noncontact water from open hearth furnace and small amount of treated sanitary water
	018	Grit water from basic oxygen furnaces, contact and noncontact basic oxygen furnace, powerhouse cooling water

Table 41. Projected Municipal Storm Water and Combined Sewage Point Source Discharges into the GCR-IHC (Source R36, Table 7) (see Figure 29)

Base Map Designation	Location (miles)	Community	Storm Sewer Overflow Location	Present Estimated Overflows (mg/year)	Drainage Area Served (acres)	Sewer Size (in.)	Projected Flows (mg/year)	Flows mg/1-yr. Storm	BOD lb/storm	S.S. lb/storm	Total _ lb/storm	Total P lb/storm	Notes
INDIANA HARBOR CANAL NORTH OF LAKE GEORGE BRANCH													
ST-27	(Ship Canal)	East Chicago	Dickey Road	32	50	48	32	0.896	141.9	12,681	15.7	9.71	
SA-28	(Ship Canal)	East Chicago	Dickey Road	13	20	10	0	0	0	0	0	0	a
ST-25	(Ship Canal)	East Chicago	Canal Street	78	41	30	85	2.38	377	33,684	41.6	25.8	b
C-26	(Ship Canal)	East Chicago	Ship Turnaround of Ship Canal	232	391	96	255	7.14	1131	101,052	125.0	77.4	a,b
LAKE GEORGE BRANCH													
ST-24	2.0	East Chicago	Indianapolis Blvd.	10	15	--	10	0.28	44.3	3,963	4.90	3.04	
ST-23	2.0	East Chicago	Indianapolis Blvd.	7	11	12	7	0.196	31.0	2,774	3.43	2.13	
ST-22	2.0	East Chicago	Indianapolis Blvd.	10	15	24	10	0.28	44.3	3,963	4.90	3.04	
INDIANA HARBOR CANAL SOUTH OF LAKE GEORGE BRANCH													
ST-21	(Ship Canal)	East Chicago	Columbus Drive	7	11	--	7	0.196	31	2,774	3.43	2.13	
GRAND CALUMET RIVER WEST OF INDIANA HARBOR CANAL													
ST-5	3.1	East Chicago	Toll Rd. Pumping Sta.	65	574	--	65	1.82	288	25,758	51.9	19.7	
ST-6	2.9	East Chicago	Grand Calumet River West of Indianapolis Blvd.	30	95	24	30	1.68	266	23,777	22.4	18.2	
ST-8	3.1	East Chicago	Indianapolis Blvd.	42	57	24	42	1.176	186	16,644	20.6	12.7	
GRAND CALUMET RIVER EAST OF INDIANA HARBOR CANAL													
ST-11	6.4	East Chicago	Cline Ave.	264	660	--	340	9.52	1,508	134,736	167.0	103	d
ST-17	12.8	Gary	Virginia Street	395	735	30	395	11.06	1,753	156,531	194	120	c
C-10	6.4	East Chicago	Cline Ave.	486	252	--	624	17.5	2,773	247,677	306.0	190.0	
C-12	7.4	Gary	Cofax Street	749	1,179	96	749	20.97	3,323	296,787	367	227	c
C-13	9.8												
C-15	11.5	East Chicago	Pierce Street	273	430	108	273	7.64	1,210	108,128	134	82.8	c
C-16	11.6	--	Polk Street	89	141	78	89	2.38	394.5	35,240	43.6	26.9	c
C-18	13.0	--	Alley 9 East	587	924	96	587	16.44	2,605	232,674	288	178	c
C-19	13.1	--	Rhode Island Ave.	1,253	1,972	132	1,253	35.08	5,558	496,485	614	380	c
ST-20	16.4	Gary	Grand Boulevard	377	593	90	377	10.55	1,671	149,314	105	114	c

[a] Will discharge to proposed sanitary sewer system.
[b] Increased flows due to anticipated improvements within area.
[c] The projected population increase of 8,935 persons for Gary assumed not to change run-off quantities.
[d] Increased flows due to multi-family housing developments with resultant increased run-off.

Table 42. Point Source Pollution Trends in the East Branch, Grand Calumet River (Source R20, Table 7) (see Figure 29)

Discharge No.	Discharger (Outfall No.)	Flow, mgd H-Qual 9/83	Flow, mgd H-Qual 10/83	Flow, mgd USGS 10/84	$CBOD_u$, lb/day** H-Qual 9/83	$CBOD_u$, lb/day** H-Qual 10/83	$CBOD_u$, lb/day** USGS 10/84	NH_4-N, lb/day H-Qual 9/83	NH_4-N, lb/day H-Qual 10/83	NH_4-N, lb/day USGS 10/84	Total Phenols, lb/day H-Qual 9/83	Total Phenols, lb/day H-Qual 10/83	Total Phenols, lb/day USGS 10/84	TDS, lb/day H-Qual 9/83	TDS, lb/day H-Qual 10/83	TDS, lb/day USGS 10/84
27	U.S. Steel (002)	36.3	27.5	28.2	5,056	344	1,529	0	46	136	BDL	BDL	BDL	61,759	38,989	43,300
28	U.S. Steel (005)	1.8	2.0	0.84	369	50	31.5			6.5	BDL		0.1	2,447	3,169	1,210
29	U.S. Steel (007)	15.5	12.8	8.00	129	320	867	719	288	113	1.2	2.2	4.3	28,181	21,350	16,900
30	U.S. Steel (010)	3.4	1.7	4.12	284	37	240	48	20	21.6	0.3	1.8	53.6	5,274	2,552	5,570
31	U.S. Steel (015)	1.8	1.6	1.85	173	28	46.3	8		1.4	BDL	0.1	BDL	2,822	2,535	2,690
32	U.S. Steel (018)	42.2	34.2	36.1	387	314	1,505	107	185	160	BDL	BDL	5.2	59,831	42,784	50,600
33	U.S. Steel (019)	46.3	39.6	37.3		495	1,244	11	30	28	BDL	3.6	BDL	63,716	49,540	44,800
34	U.S. Steel (020)	81.6	65.8	75.8		659	1,897	12	38	107	BDL	BDL	32.9	122,498	98,779	125,000
35	U.S. Steel (028)	23.4	16.4	4.97		164	536	15	93	53.9	BDL	0.1	0.04	42,349	23,251	6,920
36	U.S. Steel (030)	59.9	36.5	30.2		369	3,022			242	BDL	1.5	BDL	106,907	48,706	48,600
37	U.S. Steel (032)	2.7	2.6	2.55	14	161	64	1		1.1			BDL	4,414	4,337	3,450
38	U.S. Steel (033)	2.1	1.5	1.70	77	46	99	11		8.1			BDL	2,644	2,752	5,660
39	U.S. Steel (034)	33.4	25.9	21.8	7,187	2,268	5,636	8	13	40.0	BDL	1.1	12.2	122,565	87,082	95,100
2	Gary POTW (001)	33.5	27.3	32.7	1,118	1,434	3,818	606	706	166	BDL	BDL	0.5	130,475	126,819	131,000
42	Industrial disposal (001)	0.78	1.19		159	95						BDL		18,293	28,841	
40	Vulcan Materials (001)	0.10	0.14	0.10	22	5	3.3			0.1		BDL	BDL	2,318	1,004	315
7	E.I. duPont (001)	3.3		4.52	107	107	452			52.8			0.6	7,348	7,348	10,700
8	E.I. duPont (002)	1.09	0.48	1.14	62	62	238			12.4			BDL	3,627	1,021	11 800
9	E.I. duPont (003)	0.57	0.60	0.70	11	11	38			0.8			0.03	49,059	36,569	53,100
6	Harbison Walker (001)	0.01	0.01	0.04	0	0	1.3			0.1			0	14	8	55
10	U.S.S. Lead (001)	0.06	0.06	0.01	4	4	0.6			0.1			BDL	200	605	59
-	U.S. Steel (031)			7.05			176			7.1			BDL			13,800

(Continued)

Note: BDL indicates below detection limit for the particular analysis. Blank indicates analysis not performed for that outfall.
* HydroQual (1984) and USGS (1985 unpublished data).
** $CBOD_u$ = ultimate carbonaceous biochemical oxygen demand.

Table 42 (Concluded)

Discharge No.	Discharger (Outfall No.)	Cyanide, lb/day			Iron, lb/day			Mercury, lb/day			Chromium, lb/day			Lead, lb/day		
		H-Qual 9/83	H-Qual 10/83	USGS 10/84	H-Qual 9/83	H-Qual 10/83	USGS 10/84	H-Qual 9/83	H-Qual 10/83	USGS 10/84	H-Qual 9/83	H-Qual 10/83	USGS 10/84	H-Qual 9/83	H-Qual 10/83	USGS 10/84
27	U.S. Steel (002)	3	BDL	9.4			89.4			0.1			BDL			0.2
28	U.S. Steel (005)			0.1			2.2	BDL		0.005	BDL		BDL			BDL
29	U.S. Steel (007)	BDL	3.2	BDL			24			0.2			BDL			BDL
30	U.S. Steel (010)	BDL	BDL	1.7	3		14.1			0.01			0.07			BDL
31	U.S. Steel (015)	BDL		BDL			8.3			0.005			BDL	BDL		0.3
32	U.S. Steel (018)	BDL	BDL	BDL			75.3			0.2			0.09			BDL
33	U.S. Steel (019)	BDL	BDL	BDL			109			0.09			BDL			BDL
34	U.S. Steel (020)	BDL	BDL	37.9			544	BDL		0.6			BDL			2.5
35	U.S. Steel (028)	BDL		BDL	74	248	19.5			0.008			0.08			BDL
36	U.S. Steel (030)			12.6	190	490	191			0.3			0.3			0.8
37	U.S. Steel (032)			BDL	5	2	4.5			0.009			0.04			0.02
38	U.S. Steel (033)			BDL			85			0.02			0.01			0.04
39	U.S. Steel (034)	BDL	BDL	BDL	89	173	200			0.2	BDL	BDL	0.2			BDL
2	Gary POTW (001)	BDL	BDL	BDL	53	39	123	BDL	BDL	0.1	BDL	BDL	BDL	BDL		0.3
42	Industrial Disposal (001)								BDL							
40	Vulcan Materials (001)			BDL			0.2			0.001			0.002			0.004
7	E.I. duPont (001)			0.004			64			0.01			0.04			0.6
9	E.I. duPont (002)			BDL			11.4			0.002			0.08	BDL	0.01	0.1
9	E.I. duPont (003)			BDL			5.8			BDL			0.04			0.2
6	Harbison Walker (001)			BDL			0.1			0.000			0.002			0.007
10	U.S.S. Lead (001)			BDL			0.2			0.000			BDL			0.000
-	U.S. Steel (031)			BDL			28.8			0.04			0.06			0.06

Table 43. General and NPDES Permit Data of Point Source Discharges Within Indiana Harbor Canal South of the Lake George Junction (Source R36, Table 14)

Discharge Number	Location (miles)	NPDES Number	SIC Code	Wastewater Source	Average Flow (MGD)	Receiving Stream	Concentration; mg/l (lb/day) S.S.	Cr (total)	Oil and Grease	pH	Data Source and Comments
I-23	Phillips Pipeline Co. (E. Chicago)	IN 0032999	2911	Cooling water and process water	--	Indiana Harbor Canal/Lake Michigan	20	--	10	6.0-9.0	NPDES Permit: Minor
I-21	Union Carbide (E. Chicago)	IN 0000043	2813	Industrial gas plant - cooling water	0.125	Indiana Harbor Canal/Lake	20	0.25	10	--	NPDES Permit data and data supplied by Union Cartbide; minor
I-33	General American Transportation Corp. Plant #2 (E. Chicago	IN 0000256	3743	Process water cooling water	0.045	Indiana Harbor Canal/Lake Michigan	30 (11.3)	--	15 (5.6)	6.0-9.0	NPDES Permit not required
I-24	Blaw-Knox Foundry and Mill Machinery, Inc. (E. Chicago)	IN 0032549 -001	3569	Stormwater only	--	Indiana Harbor Canal/Lake Michigan	--	--	--	--	Minor
I-25	Blaw-Knox	-002	3569	Stormwater, ground water, and non-contact cooling water	0.0765	Indiana Harbor Canal/Lake Michigan	--	--	10 (6.4)	6.0-9.0	NPDES Permit

-- No data.

Table 44. Flow Rates, pH and Specific Conductivity of Selected Dischargers from the GCR-IHC (Source R41, Appendix Table 2)

Outfall	Discharge Rate (mgd)	pH	Temp. °C	Specific Conductivity (uS)	$CaCO_3$ mg/L Hardness	Alkalinity
East Chicago[2]	---------	7.78	24	1464	247-259	149-160
East Chicago[1]	15.79 mgd	8.10	24	1575	133-138	253-265
Gary STP	30-35 mgd	8.10	24	728	227-255	149-159
Hammond STP	35 mgd	7.90	24	1119	200-256	235-249
U.S. Steel[2]						
002	30 mgd	8.22	24	279	115-147	112-154
007	20 mgd	8.32	24	278	128-142	112-126
010	31 mgd	7.81	24	378	137-145	112-124
018	55 mgd	8.04	24	252	117-143	100-106
020	10 mgd	7.39	24	282	125-142	100-120
030	24 mgd	8.29	24	330	132-147	113-126
034	30 mgd	7.80	24	535	211-224	98-109
E.I. Du Pont de Nemours						
003	200 gpm	7.42	24	8670	510-540	30-40
003[1]	180 gpm	7.22	24	8480	392-400	24-30
LTV Steel						
009	32.97 mgd	8.05	24	355	123-150	101-109
010	56.51 mgd	7.98	24	434	154-175	110-124
011	18,000 gpm	8.39	24	441	116-139	60-64
Inland Steel Co.						
002	92.4 mgd	8.17	24	286	90-147	96-117
008	33.8 mgd	8.10	24	301	104-138	104-119
008[1]	42.6 mgd	8.24	24	339	101-108	138-145
011	96.4 mgd	8.66	24	300	117-156	105-129
012	73.35 mgd	8.30	24	329	131-142	103-114
014	50.0 mgd	8.26	24	458	151-189	88-103
014[1]	47.7 mgd	7.87	24	467	148-164	88-96

1. Denotes fresh sample collected for definiative chronic embryo-larval testing.

2. These are rough estimates-flow data unavailable at time of collection but indicated running at normal capacity.

Table 45. Locations of Sampling Stations in the Grand Calumet River Basin (Source R12, Table 1)

Station ID	Station description	River mile	River segment
C1A	East Branch Grand Calumet River at Virginia Street	12.4	East
C3	East Branch Grand Calumet River at Bridge Street	10.0	East
C4	East Branch Grand Calumet River at Industrial Highway	8.5	East
C5	East Branch Grand Calumet River at Cline Avenue	6.5	East
C6	East Branch Grand Calumet River at Kennedy Avenue	4.7	East
C12	Indiana Harbor Ship Canal at 151st Street	3.8	East
GW1	U.S. Steel outfall 002	13.5	East
GW1A	U.S. Steel outfall 005	13.5	East
GW2	U.S. Steel outfall 007	13.3	East
GW3	U.S. Steel outfall 010	13.1	East
GW4	U.S. Steel outfall 015	12.9	East
GW6	U.S. Steel outfall 018	12.4	East
GW7	U.S. Steel outfall 019	12.3	East
GW7A	U.S. Steel outfall 020	12.2	East
GW10A	U.S. Steel outfall 028	11.8	East
GW11A	U.S. Steel outfall 030	11.6	East
GW12	U.S. Steel outfall 031	11.5	East
GW13	U.S. Steel outfall 032	11.5	East
ST14	U.S. Steel outfall 033	11.3	East
ST17	U.S. Steel outfall 034	9.2	East
GWTP	Gary wastewater-treatment plant	8.8	East
VM1	Vulcan Materials outfall 001	6.8	East
DP1	Dupont outfall 001	5.2	East
DP2	Dupont outfall 002	4.9	East
DP3	Dupont outfall 003	4.9	East
HW1	Harbison-Walker Refactories outfall 001	4.8	East
USSL1	U.S.S. Lead outfall 001	4.2	East
C7	West Branch Grand Calumet River near Indianapolis Blvd.	5.5	West
C7A	West Branch Grand Calumet River near Indiana Toll Road	4.8	West
C8	West Branch Grand Calumet River at Columbia Avenue	4.1	West
C9	West Branch Grand Calumet River at Hohman Avenue	3.0	West
C10	West Branch Grand Calumet River at Burnham Avenue	1.8	West
C11	West Branch Grand Calumet River near Burnham Park	0.9	West
ECWTP	East Chicago wastewater-treatment Plant	5.4	West
HWTP	Hammond wastewater-treatment Plant	4.5	West

Table 46. POTW Improvement, 1968-1982* (Source R20, Table 4)

POTW	Parameter	1968	1982
East Chicago	Flow, mgd	11.3	16.7
	BOD_5, lb/day (mg/ℓ)	13,700(146)	10,400(73)
	TSS, lb/day (mg/ℓ)	10,400(110)	15,000(99)
Hammond	Flow, mgd	33.4	37.9
	BOD_5, lb/day (mg/ℓ)	10,800(39)	540(1.7)
	TSS, lb/day (mg/ℓ)	9,360(37)	600(1.9)
Gary	Flow, mgd	48.5	41.4
	BOD_5, lb/day (mg/ℓ)	4,590(11)	3,107(9.0)
	TSS, lb/day (mg/ℓ)	8,480(21)	2,070(6.0)

* USEPA (1985).

Table 47. Lysimeter Surface Runoff Water Quality During Early, Wet, Unoxidized Stage (Source R24, Table 6)

Parameter	Mean Unfil. Runoff Conc. mg/ℓ	Mean Filt. Runoff Conc. mg/ℓ	USEPA Maximum Criteria
pH	7.64	7.66	NA*
Conductivity** S/m	0.0052	0.0052	NA
SS	6,600	NA	NA
DDE	<0.00001	0.00004	NA
PCB-1248	0.096	0.0015	0.014
PAHs	18.03	0.148	NA
Naphthalene	6.91	0.115	NA
Acenaphthylene	0.212	<0.005	NA
Acenaphthene	0.857	0.0131	NA
Fluorene	0.780	0.010	NA
Phenanthrene	1.67	0.0097	NA
Anthracene	0.494	<0.005	NA
Fluoranthene	1.57	<0.005	NA
Pyrene	1.35	<0.005	NA
Chrysene	0.853	<0.005	NA
Benzo(a) anthracene	0.787	<0.005	NA
Benzo(b) fluoranthene	1.12	<0.005	NA
Benzo(k) fluoranthene	1.12	<0.005	NA
Indeno(1,2,3-C D) pyrene	0.194	<0.005	NA
Dibenzo(A H) anthracene	<0.010	<0.005	NA
Benzo(G H) perylen	0.124	<0.005	NA
Heavy Metals			
Cadmium	0.154	0.0021+	0.0015-0.0024
Copper	1.79	0.0237+	0.012-0.043
Nickel	0.707	0.0297	1.1-3.1
Zinc	30.9	0.360 +	0.180-0.570
Manganese	9.64	0.0170	NA
Chromium	4.06	0.0567	2.2-9.9
Lead	6.80	0.0670	0.074-0.400
Iron	627	1.39	NA
Mercury	0.0037	<0.0002	0.0017
Arsenic	0.232	<0.005	0.440

* NA = Standards not available.
** S/m = Siemans per mieter = 0.1 X mmhos per centimetre.
\+ Concentrations eqal or exceed USEPA Maximum Water Quality Criteria Protection of Aquatic Life.

Table 48. Lysimeter Surface Runoff Water Quality During Dry, Oxidized Stage (Source R24, Table 7)

Parameter	Mean Unfil. Runoff Conc. mg/ℓ	Mean Filt. Runoff Conc. mg/ℓ	USEPA Maximum Criteria
pH	6.3	6.3	NA*
Conductivity Sm	4.9	NA	NA
SS	56	NA	NA
PCB-1248	<0.0002	<0.0002	0.014
PAH			
Naphthalene	0.025 A	0.023 A	N
Acenaphthylene	<0.005	<0.005	N
Acenaphthene	<0.005	<0.005	N
Fluorene	<0.005	<0.005	N
Phenanthrene	0.0069 A	0.0056 A	N
Anthracene	<0.005	<0.005	N
Fluoranthene	0.0067	<0.005	N
Pyrene	0.0061	<0.005	N
Chrysene	<0.005	<0.005	N
Benzo (a) anthracene	<0.005	<0.005	N
Benzo (b) fluoranthene	<0.005	<0.005	N
Indeno-1,2,3,_C D pyrene	<0.005	<0.005	N
Benzo (g h i) perylene	<0.005	<0.005	N
Heavy metals			
Cadmium	0.0011	0.0026 **,+	0.0015-0.0024
Copper	0.054	0.072 **,+	0.012-0.043
Chromium	0.027	0.0043	0.021
Nickel	0.038	0.046 **	1.1-3.1
Zinc	0.34	0.53 **,+	0.180-0.570
Manganese	0.28	0.40 **	NA
Lead	0.032	0.008 **	0.74-0.400
Iron	5.74	0.041	NA
Mercury	<0.0002	<0.0002	0.0017
Arsenic	<0.005	<0.005	0.440

* NA = No values available.

** Filtered concentrations are not statistically significantly different from unfiltered concentrations.

\+ Concentrations exceed USEPA Maximum Water Quality Criteria for Protection of Aquatic Life.

Table 49. Summary of Probable Maximum Leachate Contaminant Concentrations (Source R24, Table 5)

Contaminant	Concentration (mg/ℓ) Anaerobic	Aerobic
Arsenic	0.034	0.016
Cadmium	0.009	0.0995
Chromium	0.195	0.013
Lead	0.370	0.055
Zinc	1.27	0.454
Total PCB	0.00054	0.0032
Total PAH	1.82	0.0674

Table 50. Summary of Flow Data, Indiana Harbor Canal and Grand Calumet River (Source R18, Figure 3.1c) (see Figures 31-33)

	Flow in Cubic Feet per Second						
Site No.	Nov. 1954	May 1955	Aug. 1955	Sept. 1955	Mar. 1956	Mar. 1964	Location
1A	-	31.3	-	-	-	-	
1	52.2	69.0	-	-	-	-	
2	89.5	104	-	-	-	-	
3	265	256	329	-	225	297	Virginia Street
3A	-	344	-	-	-	-	
4	512	491	591	565	490	507	Broadway Street
4A	-	559	-	587	-	-	
5	564	582	723	640	492	657	Buchanan Street
5A	-	649	769	735	609	749	
5B	-	725	810	824	722	718	U.S. Highway 12
6	734	-	783	813	653	848	
6	-	-	-	-	-	808	
7	870	726	1010	844	806	894	Kennedy Avenue
8	785	657	977	933	855	1010	151st Street
9	117	181	209	57.1	58.0	20.1	Calumet Avenue
10	-	-	-	1040	1128	1450	Dickey Road
11	-	-	-	-	-	16.0	Burnham Avenue
	581.68	581.50	581.21	580.70	579.67	577.4 *	Monthly mean levels of Lake Michigan-Datum 1929

* Approximate elevation.

Table 51. Summary of Flow Data, Indiana Harbor Canal and Grand Calumet River (Source R18, Table 3.3) (see Figures 31-33)

Location	Flow, cfs		Flow, m^3/sec
	Typical value	Range	Typical value
Grand Calumet River, east branch	800	600 to 900	23
Grand Calumet River, west branch	70	- 40 to 90	2.0
IHC, Columbus Drive	1200	800 to 2200	34.
IHC, Dickey Rd.	1500	-	42.
IHC mouth, upstream sources	2200	1500 to 3800	62.
IHC mouth, total	3500	3150 to 4200	100.

Table 52. Flow Measurements at River Sampling Stations in Figure 20, 3-4 Oct 84 (Source R12, Table 3)

Station ID	Measurement number	Beginning time	Ending time	Discharge (ft^3/s)	Average velocity (ft/s)	Average depth (ft)	Width (ft)	Area (ft^2)
C4	1	0900	1005	406	1.2	4.3	77	328
C4	2	1055	1145	377	1.1	4.3	77	330
C4	3	1300	1342	440	1.3	4.5	77	347
C4	4	1500	1548	460	1.4	4.3	77	332
C4	5	1650	1735	480	1.5	4.3	77	331
C4	6	1900	1950	475	1.4	4.5	77	350
C4	7	2057	2142	490	1.5	4.3	77	333
C4	8	2300	2342	526	1.6	4.4	77	337
C4	9	0102	0148	542	1.6	4.4	77	336
C4	10	0303	0352	518	1.5	4.5	77	343
C4	11	0503	0547	571	1.7	4.5	77	345
C4	12	0655	0741	535	1.6	4.4	77	339
C4	13	0850	0935	559	1.5	4.9	77	374
			Average	491	1.5	4.4	77	340
C5	1	0903	1045	363	.4	5.6	168	940
C5	2	1116	1230	435	.5	5.2	168	881
C5	3	1306	1415	402	.4	5.7	168	958
C5	4	1500	1620	485	.5	5.6	168	934
C5	5	1700	1830	466	.5	5.5	168	922
C5	6	1915	2015	426	.4	5.7	168	953
C5	7	2100	2215	489	.5	5.7	168	956
C5	8	2300	0026	502	.5	5.8	168	975
C5	9	0106	0220	545	.6	5.8	168	979
C5	10	0309	0427	527	.5	6.0	168	1002
C5	11	0502	0625	526	.5	5.8	168	974
C5	12	0700	0823	514	.5	5.6	168	948
C5	13	0900	1000	553	.6	5.9	168	986
			Average	479	.5	5.7	168	954

(Continued)

Table 52 (Concluded)

[All measurements by U.S. Geological Survey; measurements at site C9 were made in the culverts beneath Hohman Avenue, measurements at all other sites were made in the stream channel; ft^3/s, cubic foot per second; ft, foot; ft^2, square foot]

Station ID	Measurement number	Beginning time	Ending time	Discharge (ft^3/s)	Average velocity (ft/s)	Average depth (ft)	Width (ft)	Area (ft^2)
C1A	1	0900	1015	127	0.8	3.2	49	155
C1A	2	1100	1215	127	.8	3.1	49	154
C1A	3	1300	1430	118	.8	3.1	49	153
C1A	4	1500	1620	128	.9	2.9	49	140
C1A	5	1700	1810	124	.8	3.1	49	154
C1A	6	1900	2015	129	.8	3.3	49	161
C1A	7	2100	2210	128	.8	3.3	49	162
C1A	8	2300	0025	129	.8	3.2	49	159
C1A	9	0100	0230	134	.9	3.2	49	156
C1A	10	0330	0435	128	.8	3.4	49	167
C1A	11	0500	0650	142	.8	3.6	49	175
C1A	12	0700	0830	118	.7	3.4	49	165
C1A	13	0900	1000	121	.7	3.5	49	171
			Average	127	.8	3.3	49	159
C3	1	0900	1020	328	.8	4.5	86	386
C3	2	1120	1240	292	.8	4.5	86	386
C3	3	1315	1420	308	.8	4.6	85	388
C3	4	1500	1615	311	.8	4.6	85	389
C3	5	1710	1815	352	.9	4.6	85	391
C3	6	1910	2015	371	.9	4.6	85	394
C3	7	2110	2220	394	1.0	4.6	86	399
C3	8	2310	0015	381	.9	4.7	86	402
C3	9	0115	0220	405	1.0	4.6	88	409
C3	10	0310	0420	416	1.0	4.6	88	408
C3	11	0515	0630	411	1.0	4.8	87	414
C3	12	0715	0820	411	1.0	4.7	87	410
C3	13	0905	1020	424	1.0	4.7	88	411
			Average	370	.9	4.6	86	399

Table 53. Effluent Discharge Measurements at Industrial and Municipal Outfalls in Figure 20, 3-4 Oct 84 *(Source R12, Table 4)*

[Measurements at U.S. Steel Corporation outfalls by U.S. Geological Survey; all other measurements by plant operators; all measurements taken at discharge point except at Hammond Wastewater-Treatment Plant where flow was metered at inflow; ft^3/s, cubic foot per second]

Station ID	Measurement number	Beginning time	Ending time	Discharge (ft^3/s)
GW1	1	0900	0920	44.9
GW1	2	1540	1600	46.1
GW1	3	2010	2010	43.0
GW1	4	0315	0315	42.0
GW1	5	0715	0715	42.0
			Average	43.6
GW1A	1	0905	0905	1.3
GW1A	2	1020	1030	2.6
GW1A	3	1545	1545	2.6
GW1A	4	0345	0345	.0
GW1A	5	0730	0730	.0
			Average	1.3
GW2	1	0920	0930	13.0
GW2	2	1050	1100	10.7
GW2	3	1615	1625	13.0
GW2	4	0410	0420	12.6
GW2	5	0745	0745	12.6
			Average	12.4
GW3	1	1010	1025	6.5
GW3	2	1135	1135	6.5
GW3	3	1640	1640	6.6
GW3	4	0445	0445	6.5
GW3	5	0800	0810	5.9
			Average	6.4
GW4	1	1055	1055	2.8
GW4	2	1435	1445	3.1
GW4	3	1825	1825	2.8
GW4	4	0500	0500	2.8
GW4	5	0835	0850	2.8
			Average	2.9

Table 54. 1986-87 Water Year Data, Little Calumet River (Source R37, Page 201)

LOCATION.--Lat 41°34'19", long 87°19'13", in NE¼SE¼ sec.15, T.36 N., R.8 W., Lake County, Hydrologic Unit 04040001, on right bank 100 ft upstream of Pennsylvania Railroad bridge, 800 ft upstream of Martin Luther King Avenue bridge at Gary, 1.3 mi downstream of highway 53, and 1.5 mi upstream from confluence with Deep River.

DRAINAGE AREA.--5.8 mi^2, approximately.

PERIOD OF RECORD.--June 1958 to September 1967, October 1968 to September 30, 1971 (discharge), December 13, 1984 to current year (gage heights only).

GAGE.--Water-stage recorder. Wooden control since Dec. 13, 1984. Datum of gage is 580.00 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Stage affected by backwater from Deep River during times of flood. Minimum gage height for the period of record may have been lower prior to December 13, 1984.

EXTREMES FOR PERIOD OF RECORD.--Maximum gage height, 11.59 ft, Nov. 21, 1985; minimum gage height, 5.74 ft, Sept. 10, 15-19, 1986. Minimum gage height not reported prior to December 13, 1984.

EXTREMES OUTSIDE PERIOD OF RECORD.-- Flood in October 1954 reached a stage of 13.09 ft, from flood mark.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 9.83 ft, June 3; minimum gage height, 5.86 ft, Aug. 13.

PROVISIONAL DATA

GAGE HEIGHT, IN FEET, WATER YEAR OCTOBER 1986 TO SEPTEMBER 1987
2400 HR VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	7.12	---	8.72	6.57	6.90	7.46	6.54	6.97	9.48	6.87	6.33	8.45
2	6.93	---	8.54	6.59	7.12	7.45	6.52	7.00	9.81	6.81	6.31	8.16
3	8.47	---	8.36	6.59	7.31	7.39	6.45	7.17	9.78	6.65	6.26	7.83
4	8.52	---	8.18	6.57	7.55	7.28	6.43	7.18	9.67	6.47	6.21	7.52
5	8.59	---	7.90	6.89	7.55	7.14	6.44	7.10	9.54	6.41	6.14	7.22
6	8.58	---	7.70	6.64	7.47	7.09	6.42	6.99	9.28	6.81	6.07	6.98
7	8.50	---	7.76	6.65	7.41	6.99	6.42	6.89	8.95	7.09	6.03	6.84
8	8.25	---	8.01	6.61	6.85	6.90	6.43	6.72	8.58	7.35	6.04	6.78
9	7.93	---	8.06	6.28	7.39	6.78	6.53	6.62	8.18	7.30	6.13	6.69
10	---	---	8.07	6.44	7.25	7.38	6.66	6.57	7.77	7.11	6.03	6.58
11	---	---	7.92	6.31	7.17	6.94	7.47	6.56	7.92	7.12	5.99	6.52
12	---	---	7.69	6.59	7.10	6.72	7.73	6.59	7.91	7.00	5.90	6.76
13	---	---	7.45	6.62	7.04	6.74	7.75	6.49	7.62	6.75	7.07	6.69
14	---	---	7.24	6.83	6.98	6.88	8.76	6.51	7.30	6.63	7.34	6.59
15	---	---	7.61	7.06	6.80	6.73	9.29	6.46	7.01	6.94	7.17	6.46
16	---	---	7.29	7.07	6.74	6.77	9.06	6.40	6.79	6.72	7.71	6.90
17	---	---	7.12	7.02	6.72	6.59	9.05	6.93	6.63	6.45	8.38	7.30
18	---	---	7.10	7.06	6.71	6.55	8.87	8.68	6.55	6.33	8.38	7.35
19	---	6.91	6.93	7.07	6.68	6.81	8.57	9.26	6.48	6.28	8.32	7.19
20	---	7.02	6.84	7.00	6.59	7.13	8.25	9.44	6.95	6.75	8.05	7.03
21	---	7.08	6.78	6.91	6.59	6.94	8.00	9.49	7.05	6.26	7.92	7.00
22	---	7.47	6.73	6.58	6.58	6.97	8.05	9.42	6.95	6.17	7.93	7.79
23	---	7.37	6.73	6.58	6.72	6.76	8.17	9.20	6.83	6.15	7.86	7.81
24	---	7.32	6.71	6.39	6.59	6.77	8.16	8.93	6.62	6.13	7.59	7.65
25	---	7.24	6.71	6.29	6.53	6.94	8.10	8.89	7.25	6.11	7.57	7.44
26	---	8.42	6.67	6.28	6.55	6.85	7.91	8.77	7.04	6.23	8.47	7.12
27	---	8.56	6.63	6.27	6.56	6.78	7.74	8.50	6.73	6.41	8.79	6.90
28	---	8.75	6.60	6.26	7.28	6.73	7.49	8.07	6.50	6.27	9.01	6.77
29	---	8.87	6.64	6.41	---	6.58	7.28	7.72	6.70	6.23	9.07	7.05
30	---	8.81	6.60	6.52	---	6.55	7.09	8.24	7.03	6.20	8.94	6.96
31	---	---	6.60	6.64	---	6.53	---	8.59	---	6.45	8.72	---
MEAN	---	---	7.35	6.63	6.95	6.91	7.59	7.69	7.70	6.60	7.35	7.14
MAX	---	---	8.72	7.07	7.55	7.46	9.29	9.49	9.81	7.35	9.07	8.45
MIN	---	---	6.60	6.26	6.53	6.53	6.42	6.40	6.48	6.11	5.90	6.46

WTR YR 1987 MEAN 7.24 HIGH 9.81 JUN 2 LOW 5.90 AUG 12

Table 55. CERCLA Sites in the AOC (Source R15, Pages 179-183)

SITE NAME	EVENT	START	COMPLETED	LEAD	REMARKS
Midco I Site	SD		01-01-75	EPA	Emergency Removal 7-
Gary, IN	PA		03-01-83		
	SI		08-01-82	EPA	
	HR		08-01-82		
	CO		06-27-84		EPA
	RP		11-24-84	EPA	RCRA 7-16-84. GEN.
Nineth Ave. Dump	SD		01-01-75	EPA	
Gary, IN	PA		02-01-83		
	SI		09-01-82	EPA	
	HR		08-01-82		RCRA 10-13-83, GEN.
	RII		09-30-82		
Gary City Landfill	SD		04-01-75	EPA	
Gary, IN	PA		04-01-84		
	SI		12-01-84		
Amoco/Whiting Ref.	SD		09-01-78	EPA	RCRA Permit Issued
AKA Amoco Oil, J&L Tankfield	PA		04-01-83		TSD, TRS, GEN
J&L = Jones & Laughlin Steel					
Whiting, IN	SI		04-15-83	EPA	
East Chicago City	SD		04-01-79	EPA	
Dump	PA		12-01-84	STATE	
Chicago, IN	SI		12-26-85	EPA	
	HR	5-86			
Gary Dev. Co., Inc.	SD		04-01-79	EPA	
Gary, IN	PA		04-01-84		
	SI		12-01-84	EPA	RCRA 11-18-80 TSD, PA, 11-18-80
Mobil Chemical Co.	SD		04-01-79	EPA	
Phosphorus Division	PA		03-01-83		
Gary, IN					
Stauffer Chem. Co.	SD		10-01-79	EPA	Interim status/Perit
Hammond, IN	PA		07-19-85	EPA	RCRA 8-12-8-, GEN, TS
	SI		06-25-86	STATE	Part A 11-19-80
	HR		12-86		RCRA status "1" cannot score
Industrial Disposal Corp. (IDC)	SD		11-01-79	EPA	Hauling Firm
East Chicago, IN	PA		01-01-84		RCRA 8-25-80, TSD
	SI				
	HR		07-01-86		

(Continued)

Table 55 (Continued)

USS Lead Refining					
Inc.	SD		01-01-80	EPA	Primary & Secondary
East Chicago, IN	PA		05-01-83		lead smelter since
	SI		07-03-85	EPA	1920. 8-18-80, GEN,
	SI2		05-12-86	EPA	______ 11-18-80.
	HR		03-16-86		RCRA status "1"
					cannot score.
Ken Industries Inc.	SD		02-01-80	EPA	RCRA 8-18-80, TSD.
Hammond, IN	SI		09-27-86		
Vulcan Materials	SD		02-01-80	EPA	
Company	PA		03-01-84		
Gary, IN	SI		08-01-82		RCRA 8-18-80, GEN,
	HR		08-01-82		Part, 11-17-80
Federated Metals	SD		03-01-80	EPA	Interim status
Corporation	PA		03-01-84	EPA	RCRA 8-18-80, GEN,
					TSD, Part A 11-18-80.
Calumet College	SD		05-01-80	EPA	
AKA Amoco Research	PA		09-01-84	State	
Fac.	SI	10-19-84		EPA	
Hammond, IN					
Calumet Containers	SD		05-01-80	EPA	Emergency Removal 5-21-
AKA Steel Container	PA		12-01-82		
Hammond, IN	PA2		08-16-85		
	SI		01-01-84	EPA	RCRA 7-16-84, GEN.
	HR		07-01-82		
Site #73	SD		06-01-80	EPA	
AKA Roland Dump	PA		01-01-84		
Gary, IN	SI		09-19-85	EPA	
	HR		05-11-86	EPA	
Energy Cooperative	SD		07-01-83	EPA	
Inc.	PA		03-01-83		
East Chicago, IN	SI		08-01-83	EPA	
	SI2		03-04-86		RCRA 01-01-80 GEN, TRS,
	HR		08-01-83		TSD. Part A, 11-13-80
Flexiflo	SD		07-01-80	EPA	
AKA Conrail Flex	PA		09-27-85	STATE	
Flo	SI	11-01-85		EPA	
Hammond, IN					
Gary Sanitary	SD		07-01-80	EPA	Claimed non-handler
District	PA		12-01-83		Part A&B withdrawn,
Lake Street Sewage	SI		09-30-86	EPA	met int. stat. RCRA GE
					11-18-80, Part A
					11-18-80

(Continued)

Table 55 (Continued)

AKA Ralston St. Lagoon Gary, IN					
Indiana Harbor Belt RR	SD		07-01-80	EPA	
Hammond, IN	PA		09-25-85	STATE	
				EPA	RCRA 8-17-82, TRS.
Industrial Cinder	SD		07-01-80	EPA	Sia. dump and various
Gary, IN	PA		04-01-84		sundry materials
	SI		09-10-85	EPA	
	HR		07-28-86		
Keil Chemical	SD		07-01-80	EPA	
Hammond, IN	SI	05-01-86			RCRA 11-04-80, GEN and ID #IND082071234 only
Cities Service Co. #95	SD		07-01-80	EPA	Open Dump
	PA		04-01-84		
Gary, IN	SI		08-21-85	EPA	
	HR		08-01-86		
Site #10 AKA IDC	SD		07-01-80	EPA	
Solidfill Site	PA		02-01-84		
AKA Laidlaw Sys.	HR		07-31-86		
Gary, IN	SI		10-01-84	EPA	
Site #63 btwn.	SD		07-01-80	EPA	
Midco 2	PA		04-01-84		
Gary, IN	SI		09-05-85	EPA	
	HR		07-24-86		
Site #18-72	SD		07-01-80	EPA	
Frontage Rd &	SI	06-23-86			
Gary, IN					
Union Carbide Corp.	SD		07-01-80	EPA	
East Chicago, IN	PA		03-01-84		RCRA 7-29-80, Part A
	SI		03-11-86	STATE	11-19-80, Part B
	HR		07-28-86		received
General American	SD		08-01-80	EPA	
Transporation Corp.	PA		02-01-84		RCRA 8-18-80, GEN, TSD
East Chicago, IN	SI		09-27-85	EPA	Part A 11-17-80
Hodges Lloyd	SD		08-01-80	EPA	Reclaimer of waste o[illegible]
AKA American Recovery Co., Inc.	PA		09-01-84	STATE	RCRA 8-18-80, GEN, TS[illegible]
East Chicago, IN					Part A 6-7-84
Indiana Harbor	SD		08-01-80	EPA	
East Chicago, IN	PA		07-01083		RCRA 8-18-80, GEN, T[illegible]
	SI	09-10-83			Part A 11-18-80.

Table 55 (Continued)

Inland Steel Co.	SD		08-01-80	EPA	
East Chicago, IN	PA		02-01-85	STATE	RCRA 8-14-80, GEN, TRS
	SI		09-05-85	EPA	TSD, UIC. Part A 11-1
	HR		07-31-86		***RCRA***
U.S. Steel Corp.,	SD		08-01-80	EPA	
Gary Works &	PA		09-01-84	STATE	
Tubing Spec.	SI		03-04-86	EPA	RCRA Part A 7-1-85.
Gary, IN	HR		07-28-86		
West Shore	SD		09-01-80	EPA	
Trucking	PA		09-25-85	STATE	
AKA McCaw	SI		09-30-86	EPA	
Warehouse					
Hammond, IN					
Bongi Cartage	SD		10-01-80	EPA	
Gary, IN	PA		04-18-86		
	SI		01-06-87		
Willet Trucking	SD		10-01-85	EPA	
Hammond, IN	PA		09-25-85	STATE	
	SI	10-01-80		EPA	
Mobil Oil Co.	SD		06-01-81	EPA	
East Chicago	PA		03-01-81		
5821 Indianapolis					
Blvd.	SI		09-16-86	EPA	
East Chicago, IN					RCRA 8-18-80. GEN.
Conservation	SD		08-01-82	EPA	Emergency Removal
Chemical	SI		05-01-84	STATE	RCRA 8-18-80, TRS, TSD
Gary, IN	HR1		08-01-82		Part A 11-19-80
	HR2		01-18-86		
Midco II	SD		08-01-82	EPA	Emergency Removal 5-14
Gary, IN	SI		08-01-84	EPA	
	HR		08-01-84		
	FS1		12-15-84		
Samocki Brothers	PA		03-01-84		Landfill
Trk.	SI		08-21-85	EPA	
Gary, IN	HR		07-30-86		
Hammond Valve Corp.	SD		03-01-85	EPA	
Hammond, IN	PA		03-21-85	STATE	RCRA 2-17-81, GEN, TSD
	SI		12-27-85	EPA	Part A 6-3-85.
	HR		07-31-86		***RCRA***
LTV Steel Co., Inc.	SD		07-31-85	EPA	
Hammond, IN	PA		07-14-86		
	SI	07-15-86			

(Continued)

Table 55 (Concluded)

House's Junk Yard Gary, IN	SD		08-20-85	STATE	
	PA		05-25-85	STATE	
	SI	10-29-85		EPA	
Hammond Sewage Treatment Hammond, IN	PA		09-26-85	STATE EPA	
General Drainage Gary, IN	SD		01-09-86	EPA	
	PA		06-23-86		
	SI	06-23-86			RCRA 7-31-80, TRS
Luria Brothers and Company Gary, IN	SD		04-23-86	EPA	
Chicago Flame Hardening East Chicago, IN	SD		05- -87	STATE	
	PA		08- -87	STATE	
Black Beauty Products Gary, IN	SD		05- -87	STATE	
	PA		08- -87	STATE	
Matz-American Plating Gary, IN	SD		05- -87	STATE	
	PA		08- -87	STATE	
Standard Alloys Hammond, IN	SD		08- -87	STATE	

SD = Site Discovery
PA = Preliminary Assessment
SI = Site Inspection
HR = Hazard Ranking System

RCRA = Resource Conservation & Recovery Act
GEN = Generator
TRS = Transporter
TSD = Treat, Store, and/or Disposal Facility
UIC = Underground Injection Control Facility
Part A = Date Facility Submitted Part A (RCRA)

(Sheet 5 of 5)

Table 56 (Concluded)

Site[1] No./Qd.	Indiana State ERRIS Number	Miles to River Bank	City	Owner or Name
21C	IND-001859032	1/3	Hammond	Stauffer Chemical
22C	IND-094760444	1/5	Hammond	Shell Oil Terminal
23C	IND-068584432	3/10	Hammond	Ruan Transport Co.
24C	IND-010294304	3/10	Hammond	Chemical Haulers
25C	IND-980500540	1/4	Gary	Site #10
26C	IND-077005916	2/5	Gary	Gary Dev. Co.
27C	IND-005444732	1/2	Gary	Vulcan Materials
*28C	————	1/10	Gary	Sanitary Dist.
*29C	IND-077001808	<1/10	Gary	Sanitary Dist.
30C	IND-074403296	1/4	Gary Co.	Andersen Dev.
31C	IND-000606731	1&1/4	Gary	Mobile Chem. Phos. Div.
32C	IND-045046810	1&1/2	Gary	RJ Conner, Inc.
33C	IND-980679849 &-980794432	1&1/10	Gary	Ninth Ave. Dumps
34C	IND-980500532	1/2	Hammond	Old Hammond Dump
*35D	IND-042329631	1/10	E. Chicago	Mobile Oil Terminal
*36D	IND-074429895	1/5	E. Chicago	Gen. American Transp. Co.
*37D	IND-980500227	1/5	E. Chicago	Sanitary Dist.
*38D	————	<1/10	Hammond	Sanitary Dist.

(1) See Figure 2-6

* Sites within 1/5 mile of river

Table 56. Waste Fill and Lagoon Sites Mapped Within the Grand Calumet Watershed (Source R13, Table 2-15)

Site[1] No./Qd.	Indiana State ERRIS Number	Miles to River Bank	City	Owner or Name
1A	IND-014387880	2	Gary	Calumet Ind.
2A	IND-077042034	1/3	E. Chicago	Hodges Lloyd
* 3A	IND-005462601	<1/10	E. Chicago	Ind. Harbor Works
4A	IND-005460753	1	Hammond	American
5A	IND-074375585	1&1/4	Whiting	Amoco Wh. Refinery
6B	IND-005159199	2/5	E. Chicago	Inland Steel
7B	IND-980607469	1&1/2	E. Chicago	Cities' Ser. Refinery
8B	IND-040888992	1	Gary	Conservation Chemical
9B	IND-980679559	4/5	Gary	MIDCO II
10B	IND-980500516	3/5	Gary	Samacki Bros. Trucking
*11B	IND-005444062	<1/10	Gary	USSC Gary Wks. & Tubing Spec.
*12B	IND-980500573	<1/10	Gary	Site #75
13B	IND-980679211	2/5	Gary	Industrial Cinder, Inc.
14B	IND-067469437	1/3	Gary	Municipal Airport
15B	IND-980500565	1	Gary	Site #18
16B	IND-044250587	3/5	E. Chicago	Industrial Disposal Co.
*17B	IND-005174354	<1/10	E. Chicago	Du Pont Co.
*18B	IND-047030226	<1/10	E. Chicago	USS Lead Refinery
19B	IND-077001147	2/5	E. Chicago	Union Carbide
20B	IND-094738762	2/5	E. Chicago	Union Carbide

(Continued)

Table 57. Waste Fills of Greatest Concern (Source R20, Table 5)

Site No.	Miles to River Bank	Owner or Name	Potential Pollutants
3A	0.1	J & L Steel	Oily wastes, heavy metal
11B	0.1	U.S. Steel	N/A
12B	0.1	Uncontrolled	N/A
17B	0.1	duPont	N/A
18B	0.1	U.S.S. Lead	Lead, arsenic
28C	0.1	Gary Sludge Lagoon	POTW sludge
29C	0.1	Gary Sludge Lagoon	POTW sludge, PCB
35D	0.1	Mobile Oil Terminal	Refinery waste
36D	0.2	GATX Corporation	Waste storage pond
37D	0.2	E. Chicago Landfill	N/A
38D	0.1	Hammond Sludge Lagoon	POTW sludge

Table 58. Results of EP-Toxicity Tests on Composition Samples from the AOC (Source R7, Table 3)

Parameter	Composite Sample Location					Maximum Concentration for characteristic of EP-Toxicity
	IH83-1	IH83-3A	IH83-4	IH83-5	IH83-6	
Arsenic	0.13	0.13	0.11	0.08	0.04	5.0
Barium	0.72	0.78	0.50	0.61	1.23	100.0
Cadmium	0.015	0.019	0.011	0.012	0.010	1.0
Chromium	0.102	0.098	0.178	0.097	0.130	5.0
Lead	0.40	0.51	0.54	0.50	0.42	5.0
Mercury	0.0003	0.0002	<0.0001	<0.0001	<0.0001	0.2
Selenium	0.001	0.001	<0.001	0.002	<0.001	1.0
Silver	0.008	0.011	0.008	0.006	0.011	5.0
Endrin	<0.002	<0.002	<0.002	<0.002	<0.002	0.02
Lindane	<0.002	<0.002	<0.002	<0.002	<0.002	0.4
Methoxychlor	<0.01	<0.01	<0.01	<0.01	<0.01	10.0
Toxaphene	<0.01	<0.01	<0.01	<0.01	<0.01	0.5
2,4,D	<0.1	<0.1	<0.1	<0.1	<0.1	10.0
2,4,5-TP Silvex	<0.1	<0.1	<0.1	<0.1	<0.1	<1.0

All units are expressed as mg/l.

Table 59. Embryo-Larval Survival/Teratogenicity Test Results on Discharges (Source R30, Table 3)

Effluent Concentration	Percent Hatchability	Relative Percent Teratogenicity Alive	Dead	Total	Survival A	B	$\bar{x}$
Inland Steel 008							
0	100	0	0	0	90	98	94
3	99	0	1.0	1.0	98	94	96
10	94	0	2.1	2.1	88	78	83
30	100	0	0	0	100	96	98
60	96	0	2.0	2.0	96	86	91
100	84 *	1	0	1.1	70	62	66 *
Inland Steel 014							
0	100	0	0	0	90	98	94
3	97	0	0	0	94	98	96
10	100	1.0	5.5	6 *	98	100	99
30	98	0	4.1	4.1*	100	94	97
60	95	2.1	7.4	9.5*	56	80	68 *
100	74 *	5.4	2.7	8.1*	2	0	1 *
DuPont de Nemours							
0	96	0	0	0	96	98	97
3	95	0	2.1	2.1	96	86	90
10	98	0	2.0	2.0	100	96	98
30	98	35.7	30.6	66.3 *	66	20	43 *
60	98	65.3	1.0	66.3 *	0	2	1 *
100	97	65.9	0	65.9 *	0	0	0 *

* - Signifies a significant deviation from the control.

Table 60. Chemistry Data from Toxicity-Teratogenicity Tests (Source R30, Table 6)

Definitive Embryo-Larval Chronic Toxicity Testing.

Effluent/ Compound	East Chicago		DuPont 003		Inland Steel 008		Inland Steel 014	
	Total	Dis- solved	Total	Dis- solved	Total	Dis- solved	Total	Dis- solved
Metals Ag ug/L	<6	<6	<6	<6	<6	<6	<6	<6
Al	186	<80	<80	<80	<80	<80	<80	<80
B	490	487	81	83	84	84	<80	115
Ba	36	28	<6	30	19	19	<6	24
Be	<1	<1	<1	<1	<1	<1	<1	<1
Cd	—	—	—	—	<10	<10	<10	<10
Co	<6	<6	<6	<6	<6	<6	<6	<6
Cr	<8	<8	<8	<8	<8	<8	<8	<8
Cu	11	10	<6	7	7	7	21	21*
Fe	685	123	106	88	<80	<80	<80	2800
Li	24	26	<10	40	<10	<10	<10	20
Mn	118	112	<5	8	5	5	<5	65
Mo	<15	<15	<15	<15	<15	<15	<15	<15
Ni	<15	<15	<15	<15	<15	<15	<15	<15
Sn	<40	<40	<40	<40	<40	<40	<40	<40
Sr	208	213*	<10	194*	116	116*	<10	147*
Ti	<25	<25	<25	<25	<25	<25	<25	<25
V	<5	<5	<5	<5	<5	<5	<5	<5
Y	<5	<5	<5	<5	<5	<5	<5	<5
Zn	81	<40	<40	58*	<40	<40	<40	141*
Ca mg/L	72	74	<.5	158	35	35	<.5	45
K	7	7	<2	3	<2	<2	<2	5
Mg	17	17	<.1	2	10	10	<.1	11
Na	221	218*	1	1700*	6	6	<1	14
As ug/L	5	3	<20	<20	<2	<2	2	<2
Se	16	16*	<2	<2	<2	<2	<2	<2
Cd	<1	<1	<1	<1	.2	.3*	.3	.6*
Pb	17	11*	<2	<2	4	10*	81	25*
Hg	0.2	0.3*	0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Effluent/ Compound	East Chicago	DuPont 003	Inland Steel 008	Inland Steel 014
Hexavalent Chromium ug Cr/L	<10	<10	<10	<10
Total Organic Carbon mg C/L	10	<3	<3	6
Ammonia mg N/L	0.35*	<0.5	<0.5	<0.5
Phenols ug Phenolics/L	30	26	28	40
Total Cyanide ug Cn/L	300*	<5	<5	19

(Continued)

Table 60 (Concluded)

Oil and Grease mg/L	<5	<5	<5	7
GC/MS semi -volatile Organic scan for Priority pollutants	NS [a]	NS	NS	NS
VOA	NS	NS	NS	NS

[a] - data was either below detection or was not significant.

* - Signifies that element or compound may be a toxic agent.

Table 61. Prediction of Bioaccumulation Potential [TBP] and Hypothetical Maximum Whole Organism Concentrations of Organics for Lipid Contents of 2 and 5% Based on TBP Potential (Source R20, Table 12)

Organic	Conc. in Sediment (µg/g)	TBP* (ppm)	Max Ct** for Lipid Contents of 2%	5%
PCBs	27	702	14	35
Naphthalene	2,000	51,975	1,040	2,599
Acenaphthylene	22	572	11	29
Acenaphthene	96	2,495	50	125
Fluorene	69	1,793	36	90
Phenanthrene	200	5,198	104	260
Anthracene	62	1,611	23	81
Fluoranthene	150	3,898	78	195
Pyrene	140	3,698	74	185
Chrysene	92	2,390	48	120
Benzo(a)anthracene	86	2,235	45	112
Benzo(b)fluoranthene	140	3,638	73	182
Benzo(k)fluoranthene	140	3,638	73	182
Benzo(a)pyrene	87	2,261	45	113
Indeno(1,2,3-cd)pyrene	50	1,299	26	65
Benzo(g h i)perylene	35	910	18	46

* TBP = (Cs/foc)/0.52 where Cs = chemical concentration in sediment (ppm) and foc = decimal fraction organic carbon in sediment.

** Ct = Tissue concentration, fresh weight (ppm).

Table 62. Concentrations of Organic Contaminants in *Cyperus esculentus* Grown in Sediments from Indiana Harbor (Source R25, Table D6)

Compound	Concentration, μg/g (ODW) Flooded	Upland
Aldrin	<0.005	<0.005
PCB-1248	<0.05	<0.05
Naphthalene	<2	<2
Acenaphthylene	<2	<2
Acenaphthene	<2	<2
Fluorene	<2	<2
Phenanthrene	<2	<2
Anthracene	<2	<2
Fluoranthene	<2	<2
Pyrene	<2	<2
Chrysene	<2	<2
Benzo(a)anthracene	<2	<2
Benzo(b)fluoranthene	<2	<2
Benzo(k)fluoranthene	<2	<2
Indeno-1,2,3-c d)pyrene	<2	<2
Dibenzo(a h)anthracene	<2	<2
Benzo(g h i)perylene	<2	<2

* Mean of four replicates.

Table 63. Concentrations of Heavy Metals in *Cyperus esculentus* Grown in Sediments from Indiana Harbor (Source R25, Table D7)

Metal	Concentration, μg/g Flooded*	Upland**
Zn	34.9*	128
Cd	0.095	14.5
Cu	1.45	12.8
Fe	138	226
Mn	38.4	453
As	<0.025	<0.025
Hg	<0.005	<0.005
Ni	0.549	0.167
Cr	2.43	14.5
Pb	1.51	47.0

* Mean of four replicates.
** Composite of four replicates.

Table 64. Metal Concentrations in Indiana Harbor Sediments and Earthworms (Source R25, Table D9)

Metal	Original Sediment	Aged** Sediment	Initial Earthworms	Bioassay Earthworms	CF
Arsenic	29.5	25.962 +/- 1.587	1.582 +/- 0.072a	2.808 +/- 0.369b	0.11
Cadmium	20.0	19.094 +/- 2.519	6.082 +/- 0.468a	9.037 +/- 0.823b	0.47
Chromium	650.0	506.729 +/- 36.102	0.000 +/- 0.000a	3.892 +/- 2.822a	0.01
Copper	282.0	237.888 +/- 7.128	11.302 +/- 0.389a	23.112 +/- 3.022b	0.10
Lead	879.0	689.730 +/- 38.902	0.457 +/- 0.122a	6.530 +/- 3.088b	0.01
Mercury	0.530	0.522 +/- 0.904	0.059 +/- 0.103a	0.000 +/- 0.000a	0.00
Nickel	137.0	111.860 +/- 1.401	1.302 +/- 0.295a	3.225 +/- 0.829b	0.03
Zinc	4125.0	3767.454 +/- 114.381	118.426 +/- 5.693a	149.956 +/- 19.096a	0.04

* Mean of three replicates +/- standard deviation expressed as μg/g (=ppm) dry weight. Means in a row followed by the same letter are not significantly different according to Duncan's New Multiple Range procedure at alpha = 0.05.

** 6-month aging.

Time = 0.

Time = 28 days.

Concentration factor (ratio of concentration in worms to that in the aged sediment).

Table 65. PCB Concentrations in Indiana Harbor Sediments and Earthworms (Source R25, Table D9)

Chlorobiphenyls	Original Sediment	Aged** Sediment	Initial Earthworms	Bioassay Earthworms
2,4-Di	<0.002	<0.010 +/- 0.000	<0.008 +/- 0.000a	<0.008 +/- 0.002a
2,4'-Di	4.3	<0.013 +/- 0.006	0.015 +/- 0.008a	0.020 +/- 0.020a
2,4-4'-Tri	17.5	<0.010 +/- 0.000	<0.008 +/- 0.000a	<0.008 +/- 0.002a
2,3',4',5-Tetra	27.0	3.550 +/- 1.210	<0.010 +/- 0.004a	1.365 +/- 0.391b
2,2',4,5'-Tetra	7.8	5.007 +/- 1.782	0.025 +/- 0.011a	1.137 +/- 0.807a+
2,2',5,5'-Tetra	35.0	<0.010 +/- 0.000	<0.015 +/- 0.013a	<0.008 +/- 0.002a
2,2',4,6-Tetra	17.5	<0.010 +/- 0.000	<0.008 +/- 0.000a	<0.008 +/- 0.002a
2,2',3',4,5-Penta	4.55	1.787 +/- 0.858	0.013 +/- 0.004a	0.614 +/- 0.165b
2,2',4,5,5'-Penta	1.55	<0.010 +/- 0.000	<0.008 +/- 0.000a	<0.008 +/- 0.002a
2,2',3,4,5'-Penta	4.9	1.417 +/- 0.761	<0.008 +/- 0.000a	0.554 +/- 0.164b
2,2',3,4,4',5'-Hexa	2.6	1.149 +/- 0.753	0.008 +/- 0.000a	0.216 +/- 0.064b
2,2',4,4',5,5'-Hexa	1.3	<0.457 +/- 0.774	<0.008 +/- 0.000a	<0.008 +/- 0.002a
2,2',3,3',6,6'-Hexa	<0.002	<0.010 +/- 0.000	<0.008 +/- 0.000a	<0.008 +/- 0.002a
2,2',3,4,5,6'-Hexa	11.5	<0.010 +/- 0.000	<0.010 +/- 0.004a	<0.008 +/- 0.002a
2,2',3,4,4',5,5'-Hepta	1.85	1.660 +/- 1.449	<0.008 +/- 0.000a	0.104 +/- 0.047b

* Mean of three replicates +/- standard deviation expressed as μg/g (=ppm) dry weight. Means in a row followed by the same letter are not significantly different according to Duncan's New Multiple Range procedure at alpha = 0.05.

** 6-month aging.

Time = 0.

Time = 28 days.

The analysis of variance indicated that uptake could be considered marginally significant:probability > F = 0.0754.

Expressed as Aroclor 1248 in the original sediment only.

Table 66. PAH Concentrations in Indiana Harbor Sediments and Earthworms (Source R25, Table D9)

PAH	Original Sediment	Aged** Sediment	Initial Earthworms	Bioassay Earthworms
Naphthalene	2033.333 +/- 57.735a	46.267 +/- 1.258b	d	d
Acenaphthylene	21.667 +/- .577	d	d	d
Acenaphthene	105.333 +/- 8.083	d	d	d
Fluorene	78.333 +/- 8.145a	4.287 +/- 0.731b	d	d
Phenanthrene	206.667 +/- 11.547a	14.267 +/- 3.650b	d	d
Anthracene	63.333 +/- 1.528a	74.033 +/- 6.269b	d	35.264 +/- 16.37
Fluoranthene	160.000 +/- 10.000a	36.933 +/- 5.659b	d	d
Pyrene	143.333 +/- 5.774a	74.033 +/- 6.269b	d	35.264 +/- 16.37
Chrysene	95.667 +/- 4.041a	25.500 +/- 5.724b	d	12.218 +/- 5.92
Benzo(a)anthracene	102.000 +/- 13.856a	21.633 +/- 2.363b	d	d
Benzo( )fluoranthene	156.667 +/- 15.275a	41.700 +/- 19.213b	d	20.915 +/- 10.49
Benzo(a)pyrene	105.667 +/- 16.921a	33.900 +/- 10.789b	d	18.420 +/- 5.90
Indeno(1,2,3-c,d)pyrene	57.000 +/- 10.440a	18.513 +/- 12.491b	d	9.295 +/- 2.78
Dibenzo(a,h)anthracene	13.667 +/- 6.351a	d	d	d
Benzo(g,h,i)perylene	39.667 +/- 4.163a	4.280 +/- 7.703b	d	4.497 +/- 0.74
Total PAH	3382.333 +/- 142.388a	388.217 +/- 80.765b		131.430 +/- 11.17

Note: d = detection limit.

* Means of three replicates +/- standard deviation expressed as µg/g (=ppm) dry weight. Means in a row followed by the same letter are not significantly different according to Duncan's New Multiple Range procedure at alpha = 0.05.

** 6-month aging.

Time = 0.

Time = 28 days.

Benzo(b)fluoranthene + Benzo(k)fluoranthene.

Table 67. Summary of Electrofishing Catch from Station F in the Indiana Harbor Canal, 2 Dec 84 (Source R39, Table 2)

Fish Species Collected	Number of Fish	Total Weight of Fish (g)	Catch Per 30 Minutes		Catch Per 400 Meters		Percent of Total Catch	
			Number of Fish	Weight of Fish (g)	Number of Fish	Weight of Fish (g)	Number of Fish	Weight of Fish (g)
Alewife	1	4.61	0.34	1.55	0.50	2.31	0.45	0.05
Gizzard shad	72	500.62	24.13	167.81	36.00	250.31	32.58	4.98
Central mudminnow	1	1.08	0.34	0.36	0.50	0.54	0.45	0.01
Goldfish	26	180.20	8.72	60.40	13.00	90.10	11.76	1.79
Carp	7	8,859.92	2.35	2,969.81	3.50	4,429.96	3.17	88.18
Fathead minnow	22	19.56	7.37	6.56	11.00	9.78	9.95	0.19
Pumpkinseed	28	329.28	9.39	110.37	14.00	164.64	12.67	3.28
Yellow perch	64	151.76	21.45	50.87	32.00	75.88	28.96	1.51
TOTALS	221	10,047.03	74.09	3,367.73	110.50	5,023.52		

* Total electrofishing time and distance, 89 minutes, 30 seconds, and 800 meters, respectively.

Table 68. Concentrations of Major, Minor, and Trace Elements in Fish and Crayfish from Indiana Harbor and Adjacent Lake Michigan* (Source R1, Table 13) (see Figure 47)

Sample No.	Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	Hg (ppb)	K
R-Carp-1	<DL	<DL	1.32	0.98	<DL	5850	0.12	<DL	<DL	1.94	53.4	60.5	2870
R-Carp-2	<DL	<DL	0.40	0.84	<DL	11900	<DL	<DL	1.5	1.14	40.0	78.1	2660
R-Carp-3	<DL	<DL	0.90	0.80	<DL	11200	0.20	<DL	<DL	1.75	48.6	135.J	3050
Q-Carp-1	5.43	<DL	<DL	0.81	<DL	7950	<DL	<DL	<DL	1.71	106.	40.9	3120
Q-Carp 2	5.50	<DL	<DL	0.64	<DL	7280	<DL	<DL	1.7	1.73	79.2	34.1	2220
Q-Carp 3	6.09	<DL	1.09	1.19	<DL	11200	<DL	<DL	1.5	1.58	96.5	40.1	2630
Q-Carp-4	11.10	<DL	0.89	0.59	<DL	6140	<DL	<DL	2.2	1.29	149.	44.4	2750
Q-Carp-5	8.27	<DL	0.56	0.86	<DL	20600	<DL	<DL	2.0	1.41	123.	<DL	4460
Q-Carp-6	6.51	<DL	2.92	0.30	<DL	1650	<DL	<DL	1.5	1.88	85.1	11.2	2000
R-Shad-1	2.89	<DL	<DL	0.26	<DL	1590	<DL	<DL	1.4	1.12	35.3	54.7	2260
R-Shad-2	3.75	<DL	1.29	0.57	<DL	6330	<DL	<DL	1.1	3.29	105.0	24.2	2630
R-Shad-3	4.09	<DL	1.63	0.61	<DL	5150	<DL	<DL	1.4	1.17	125.0	15.7	2660
R-Shad-4,5	4.12	<DL	<DL	0.46	<DL	5420	<DL	<DL	<DL	3.29	83.8	21.8	3030
R-Shad-6,11	5.05	<DL	0.34	0.34	<DL	1980	<DL	<DL	1.3	2.04	80.1	<DL	1820
R-Shad-12	7.00	<DL	0.92	0.29	<DL	2060	<DL	<DL	1.7	5.24	85.4		3300
R-Shad-13,14	194.00	<DL	1.42	0.60	<DL	10100	<DL	<DL	<DL	1.61	38.9	26.6	2340
Det. Limit (DL)	1.61	1.30	0.12	0.03	0.03	0.39	0.110	0.250	1.2	0.36	1.3	5.0	56

Sample No.	Mg	Mn	Mo	Na	Ni	P	Pb	Sb	Se	Si	Sn	V	Zn
R-Carp-1	298	2.30	<DL	1160	0.41	4810	<DL	0.81	1.54	1.03	1.78	<DL	134
R-Carp-2	389	2.87	<DL	1020	1.19	7260	<DL	<DL	1.29	0.58	2.77	<DL	86
R-Carp-3	354	2.60	<DL	1100	0.35	7340	<DL	<DL	1.50	1.14	<DL	<DL	77
Q-Carp-1	317	4.14	<DL	1140	0.33	5690	1.05	<DL	2.19	1.39	2.76	<DL	119
Q-Carp-2	247	3.37	<DL	893	0.35	4860	1.29	<DL	1.78	0.39	3.56	<DL	80
Q-Carp-3	383	4.95	<DL	1150	0.30	7100	1.09	<DL	1.24	0.58	<DL	<DL	109
Q-Carp-4	318	4.90	<DL	980	1.63	4880	<DL	<DL	1.93	3.57	<DL	<DL	117
Q-Carp-5	677	6.57	<DL	1710	0.35	12500	1.11	<DL	5.15	1.44	<DL	<DL	123
Q-Carp-6	170	2.87	<DL	676	0.40	2030	<DL	<DL	1.09	<DL	<DL	<DL	46
R-Shad-1	181	1.84	<DL	666	0.36	2180	<DL	<DL	0.77	<DL	<DL	<DL	14
R-Shad-2	248	6.24	<DL	904	0.33	4380	<DL	<DL	1.24	0.96	3.43	<DL	17
R-Shad-3	235	5.36	<DL	711	0.41	3800	<DL	<DL	0.77	0.43	1.73	<DL	17
R-Shad-4,5	262	3.66	<DL	703	0.28	4120	<DL	<DL	<DL	1.38	1.76	<DL	14
R-Shad-6,11	156	4.81	<DL	524	<DL	1980	<DL	<DL	1.41	1.04	<DL	<DL	12
R-Shad-12	245	3.40	<DL	882	1.41	2820	<DL	<DL	2.33	1.51	2.43	<DL	30
R-Shad-13,14	283	3.44	<DL	709	<DL	5930	<DL	<DL	1.51	2.14	<DL	1.01	19
Det. Limit (DL)	0.21	0.51	0.22	218	0.27	2.65	0.94	0.80	0.63	0.37	1.10	0.98	0.50

* ppm unless otherwise indicated.

(Continued)

(Sheet 1 of 3)

Table 68 (Continued)

Sample No.	Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	Hg (ppb)	K
Q-Shad 1	2.6	<DL	1.43	0.41	<DL	4290	<DL	<DL	<DL	1.12	53.6	53.0	2600
Q-Shad-7	7.4	<DL	1.01	1.08	<DL	14100	<DL	<DL	1.2	1.41	98.2	29.0	2360
R-Ale-1	2.6	1.38	1.62	0.33	<DL	6000	<DL	<DL	<DL	1.19	31.5	80.3	2520
R-Ale-2	<DL	1.15	0.25	0.20	<DL	5800	<DL	<DL	1.6	0.80	24.2	82.3	2470
R-Ale-3	1.8	<DL	1.53	0.60	<DL	9400	<DL	<DL	1.2	1.11	27.7	53.0	2780
R-Ale-4,5	<DL	<DL	0.79	0.36	<DL	7300	<DL	<DL	1.3	0.78	24.7	26.3	2390
R-Ale-6	<DL	<DL	<DL	0.45	<DL	10500	<DL	<DL	1.7	1.05	32.5	37.4	2760
Q-Ale-1	4.0	<DL	4.86	0.55	<DL	7970	<DL	<DL	<DL	0.64	50.5	27.6	1630
Q-Ale-2	9.8	<DL	<DL	0.58	<DL	7500	<DL	<DL	1.[illegible]	0.91	73.6	39.4	2340
T-Ale-1	<DL	<DL	<DL	0.35	<DL	7200	<DL	<DL	<DL	0.70	26.4	38.5	1910
R-OVIR-1	569.	<DL	<DL	43.40	<DL	37100	0.278	<DL	1.9	25.00	685.0	17.2	1500
R-OVIR-2	97.6	2.03	<DL	14.50	<DL	38300	0.297	<DL	2.4	27.30	1140.0	<DL	1320
T-OVIR-1	109.	<DL	1.80	23.40	<DL	41000	<DL	<DL	<DL	30.20	140.0	16.1	1130
Det. Limit (DL)	1.6	1.30	0.12	0.03	0.03	0.39	0.11	0.25	1.2	0.36	1.3	5.0	56

Sample No.	Mg	Mn	Mo	Na	Ni	P	Pb	Sb	Se	Si	Sn	V	Zn
Q-Shad 1	245.	3.93	<DL	715	0.31	3600	<DL	<DL	<DL	0.43	1.12	<DL	18.1
Q-Shad-7	368.	6.89	<DL	818	0.30	8290	<DL	<DL	<DL	1.72	<DL	<DL	26.2
R-Ale-1	224.	2.95	<DL	681	<DL	4190	<DL	<DL	<DL	0.93	<DL	<DL	33.4
R-Ale-2	210.	3.15	<DL	766	<DL	4010	<DL	<DL	<DL	1.07	<DL	<DL	28.2
R-Ale-3	294.	3.47	<DL	767	<DL	6040	<DL	<DL	0.74	0.60	<DL	<DL	23.0
R-Ale-4,5	250.	2.82	<DL	641	<DL	4960	<DL	<DL	<DL	0.54	<DL	<DL	28.9
R-Ale-6	322.	4.85	<DL	854	0.35	6850	<DL	<DL	<DL	0.58	<DL	<DL	31.7
Q-Ale-1	221.	3.27	<DL	396	<DL	4850	<DL	<DL	<DL	1.23	<DL	<DL	20.6
Q-Ale-2	236.	5.19	<DL	629	0.39	4800	<DL	<DL	<DL	<DL	<DL	<DL	24.0
T-Ale-1	224.	3.85	<DL	414	<DL	4640	<DL	<DL	<DL	<DL	<DL	<DL	19.6
R-OVIR-1	718.	373.0	<DL	1530	1.76	3210	<DL	0.88	<DL	3.91	<DL	2.22	62.0
R-OVIR-2	535.	180.0	<DL	1200	1.39	3170	6.24	0.94	<DL	6.74	<DL	1.93	47.9
T-OVIR-1	662.	32.5	<DL	1150	<DL	3510.	<DL	<DL	<DL	2.00	<DL	1.52	27.5
Det. Limit (DL)	0.21	0.51	0.22	218	0.27	2.65	0.94	0.80	0.63	0.37	1.10	0.98	0.470

(Continued)

Table 68 (Concluded)

Sample No.	Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	Hg (ppb)	K
Q-PACU-1	37.1	<DL	0.97	6.79	<DL	27400	<DL	<DL	3.5	22.00	575.0	<DL	1820
Q-PACU-2	21.5	<DL	1.94	2.48	<DL	11500	<DL	<DL	2.0	10.10	168.0	<DL	771
Q-SUN-1,2,3	<DL	<DL	1.70	0.05	<DL	12	<DL	<DL	<DL	<DL	<DL	31.0	<DL
R-SUN-1,2,3	9.5	<DL	1.19	0.63	<DL	20900	<DL	<DL	<DL	1.32	67.3	<DL	3100
S-ORUS-1	26.9	<DL	1.99	39.0	<DL	56900	<DL	<DL	1.3	31.50	39.7	15.1	885
Q-Gold-1	3.64	<DL	0.35	0.62	<DL	15500	<DL	<DL	2.2	1.30	50.7	17.5	2140
Q-Gold-2,3	4.8	<DL	<DL	0.58	<DL	13000	<DL	<DL	1.2	1.20	63.5	12.2	1880
S-PER-1-10	<DL	<DL	<DL	0.90	<DL	13200	<DL	<DL	<DL	<DL	14.3	22.8	2790
Det. Limit (DL)	1.6	1.30	0.12	0.03	0.03	0.39	0.11	0.25	1.2	0.36	1.3	5.0	56

Sample No.	Mg	Mn	Mo	Na	Ni	P	Pb	Sb	Se	Si	Sn	V	Zn
Q-PACU-1	434.	29.8	<DL	1250	0.66	2380	2.83	1.60	<DL	1.19	<DL	1.84	31.6
Q-PACU-2	174.	10.8	<DL	535	0.28	1240	1.26	<DL	<DL	<DL	<DL	<DL	19.2
Q-SUN-1,2,3	0.51	<DL	<DL	<DL	<DL	3.76	<DL	<DL	<DL	1.24	<DL	<DL	3.0
R-SUN-1,2,3	501.	5.54	<DL	865	0.48	11000	<DL	<DL	<DL	0.71	<DL	<DL	36.2
S-ORUS-1	702.	16.2	<DL	951	<DL	3920	1.15	1.68	<DL	<DL	<DL	1.44	18.8
Q-Gold-1	437.	2.11	<DL	1000	0.29	9170	1.01	<DL	1.66	1.39	<DL	<DL	60.4
Q-Gold-2,3	396.	2.74	<DL	729	6.25	7960	<DL	<DL	1.59	<DL	<DL	<DL	59.1
S-PER-1-10	382.	1.85	<DL	698	0.300	8330	<DL	<DL	<DL	<DL	<DL	<DL	22.5
Det. Limit (DL)	0.21	0.51	0.22	218	0.27	2.65	0.94	0.80	0.63	0.37	1.10	0.98	0.50

(Sheet 3 of 3)

Table 69. Catch per Unit Effort During Electrofishing (Source R1, Table 21a) (see Figure 47)

Station	Time Shocked	Catch	Total Weight (grams)	Weight(g)/Hour
Q	2 hr	25 Gizzard Shad 6 Carp 2 Alewives 5 Goldfish 1 Emerald Shiners 3 Sunfish, BGxPS 24 Golden Shiners Total = 66 Fish	15,989	7950
R	3 hr	14 Gizzard Shad 3 Carp 25 Alewives 3 Sunfish, BGxPS Total = 45 Fish	17,461	5820
S	1 hr	0 Fish	0	0

Table 70. Catch per Unit Effort During Trawling (Source R1, Table 21b) (see Figure 47)

Station	Time (hours)	Distance (naut. miles)	Catch	Total Weight (grams)	Weight(g)/naut. mile
T	1.12*	1.83	3 Alewives	93.8	51.3

* This is the sum of three trawls.

Table 71. Catch per Unit Effort in Crayfish Traps (Source R1, Table 21c) (see Figure 47)

Station	# Traps	Catch	Total Weight (g)	Weight(g)/Trap
Q-beg	2	1 *P. acutus* 1*O. virilis*	27.4	13.7
Q-end	2	6 *P. acutus*	129.5	64.8
R-beg	3	7 *O. virilis*	87.1	29.0
R-end	3	8 *O. virilis*	93.1	31.0
S-beg	3	1 *E. nigrum*	1.1	0.37
S-end*	2	30 *P. flavescens* 1 *C. bairdi* 1 *O. rusticus*	1833.8	611.3

* All traps were recovered after one day, with the exception of two traps at S-end; one was recovered empty and the other was left for 16 days.

Table 72. Concentrations of Major, Minor, and Trace Elements in Periphyton and Plankton from Indiana Harbor and Adjacent Lake Michigan (Source R1, Table 14) (see Figure 47)

Sample No.	Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	Hg (ppb)	K
Periphyton													
R-925	117.0	1.80	4.74	2.47	<DL	4020	0.31	<DL	3.2	0.46	1470	<DL	459
R-926	151.0	3.25	4.85	3.64	<DL	6410	0.49	<DL	4.5	0.39	2310	<DL	423
R-929	135.0	3.25	2.72	1.94	<DL	1140	0.437	<DL	6.07	2.33	2060	<DL	835
R-935	768.0	8.65	20.40	11.10	0.05	6350	2.50	1.35	27.8	11.0	11500	13.3	865
Plankton													
Q-5	481.0	5.44	5.54	8.48	0.05	1250	1.52	<DL	28.0	15.2	5490	51.8	150
R-8	377.0	2.97	3.42	4.90	0.05	1320	0.89	<DL	12.2	7.57	3200	31.9	171
Det. Limit (DL)	1.61	1.30	0.12	0.03	0.03	0.39	0.11	0.25	1.2	0.36	1.3	5.0	56

Sample No.	Mg	Mn	Mo	Na	Ni	P	Pb	Sb	Se	Si	Sn	V	Zn
Periphyton													
R-925	503	78.9	<DL	<DL	0.83	127.	1.75	<DL	<DL	N.A.	1.55	<DL	27.3
R-926	539	112.	<DL	<DL	1.07	136.	2.86	0.825	<DL	N.A.	1.26	10.8	41.5
R-929	310	155.	<DL	<DL	1.55	111.	7.38	<DL	<DL	N.A.	1.31	4.47	32.8
R-935	1240	730.	<DL	243	6.05	303.	34.8	<DL	<DL	N.A.	6.05	13.0	140.
Plankton													
Q-5	376	263.0	<DL	601	3.28	386.	35.20	0.83	<DL	N.A.	11.7	5.64	200.
R-8	359	132.0	<DL	387	1.83	171.	15.60	0.89	<DL	N.A.	6.34	5.69	106.
Det. Limit (DL)	0.21	0.51	0.22	218	0.27	2.65	0.94	0.80	0.63	0.37	1.10	0.98	0.5

Table 73. PCB Body Burdens in Indiana Harbor Fish, Plankton, and Crayfish (Source R1, Table 12)

Sample	Total PCBs (ppb)	MDL (ppb)
PERIPHYTON-R-925	265.53	13.75
PERIPHYTON-R-926	275.41	13.75
PERIPHYTON-R-929	34.58	13.75
PERIPHYTON-R-935	109.40	13.75
PLANKTON-Q-5	162.59	13.75
PLANKTON-R-8	480.43	13.75
R-CARP-1a	4212.69	13.75
R-CARP-1b	4466.83	13.75
R-CARP-2	633.60	13.75
R-CARP-3	981.95	13.75
Q-CARP-1	1817.20	13.75
Q-CARP-2	7863.95	13.75
Q-CARP-3	453.74	13.75
Q-CARP-4	1620.89	13.75
Q-CARP-5	1181.49	13.75
Q-CARP-6	200.41	13.75
R-SHAD-1	986.22	13.75
R-SHAD-2	265.81	13.75
R-SHAD-3	142.39	13.75
R-SHAD-4,5	1618.30	13.75
R-SHAD-6,11a	915.27	13.75
R-SHAD-6,11b	891.42	13.75
R-SHAD-12	117.08	13.75
R-SHAD-13,14	119.75	13.75
Q-SHAD-1	418.48	13.75
Q-SHAD-7a	211.74	13.75
Q-SHAD-7b	206.66	13.75
R-ALE-2	309.58	13.75
R-ALE-3	118.40	13.75
R-ALE-4,5a	15.75	13.75
R-ALE-4,5b	14.38	13.75
R-ALE-6	414.70	13.75
Q-ALE-1	125.70	13.75
Q-ALE-2	531.62	13.75
T-ALE-1	108.58	13.75
R-OVIR-1	120.79	13.75
R-OVIR-2	148.55	13.75
T-OVIR-1	90.22	13.75
Q-PACU-1	381.81	13.75
Q-PACU-2	124.95	13.75
Q-SUN-1,2,3	512.49	13.75
R-SUN-1,2,3a	763.74	13.75
R-SUN-1,2,3b	790.08	13.75
S-ORUS-1	356.29	13.75
Q GOLD-1	739.74	13.75
Q-GOLD-2,3	1130.42	13.75
S-PER-1-10	377.85	13.75
Blank 1,2 - PC	20.35	13.75
Blank 3,4 - PC	BMDL	13.75
Blank 5,6 - PC	5.91	13.75
Blank 1,2 - Extract	0.00	13.75

Table 74. Percent Difference in Oxygen Liberation [Photosynthesis] and Oxygen Consumption [Respiration] Between Control and In Situ Colonization Test Systems in an 8-hr Biological Oxygen Demand Test (Source R1, Table 16)

Station	Oxygen liberation	Oxygen consumption
Q - B	-313.6*	+49.9*
Q - E	-233.5*	+56.8*
R - B	-233.5*	+53.8*
R - E	-276.8*	+46.9*
S	lost [a]	lost [a]

* Significant difference in dissolved oxygen values between control and test systems (a=0.05). Each value is the mean of three replicates.

[a] Suspected vandalism.

Table 75. Summary of Protozoan Counts of In Situ Colonization Studies (Source R1, Table 17a)

Station	Control	IHC Q-B	IHC Q-E	IHC R-B	IHC R-E
# Species found	47	41	38	25	42
Shannon Diversity Index (H) [a]	3.52	3.06	2.84	2.80	3.47

[a] Shannon, C. 1948

Table 76. Summary of Feeding Strategies of Protozoans Represented in In Situ Colonization Studies (Source R1, Table 17b)

Feeding Strategy	Control*	IHC Q-B	IHC Q-E	IHC R-B	IHC R-E
Algivores	11.1%	7.4%	8.3%	12.5%	10.3%
Saprotrophs	0.0%	0.0%	0.0%	0.0%	0.0%
Nonselective Omnivores	8.3%	14.8%	8.3%	18.8%	13.8%
Predators	0.0%	0.0%	0.0%	0.0%	0.0%
Photosynthetic Autotrophs	19.4%	3.7%	12.5%	0.0%	10.3%
Bactivores-Detritivores	61.1%	74.1%	70.8%	68.8%	65.5%

Table 77. Percent Response for Single Species Sediment Bioassays from Indiana Harbor (Source R1, Table 18) (see Figure 47)

Station	Percent Response (r^2)		
	Microtox™	*S. capricornutum*	*P. redivivus*
1	146.07 (0.96)	97.09 (0.49)	66.62
2	152.90 (0.90)	100.01 (0.54)	43.99
3	165.50 (0.91)	87.57 (0.37)	90.69
4	130.90 (0.98)	109.37 (0.40)	72.91
5	24.19 (0.98)	119.49 (0.44)	84.63
6	183.93 (0.95)	67.27 (0.26)	37.60
7	not completed	not completed	25.80
8a	27.64 (0.94)	88.38 (0.57)	81.71
8	-2.69 (0.08)	44.98 (0.07)	20.22
9a	-7.24 (0.59)	81.83 (0.55)	40.09
10a	-5.29 (0.32)	48.18 (0.11)	8.20
11a	2.11 (0.01)	117.76 (0.28)	18.82
12a	137.07 (0.96)	102.80 (0.33)	99.22
Potting soil	-20.05 (0.19)	108.67 (0.17)	27.39
Sand	-8 46 (0.64)	102.89 (0.49)	39.75

Table 78. Aquatic Macroinvertebrates [number/square meter] Collected from Stations 1, 2, 3, 4, 5, and 12a, 3-4 May 88 (Source R1, Table 22) (see Figure 47)

SPECIES	STATION 1	2	3	4	5	12a
COELENTERATA						
Hydroida						
Hydridae	-	-	-	43	86	-
ASCHELMINTHES						
NEMATODA (unident.)	-	-	-	-	-	-
ANNELIDA						
OLIGOCHAETA						
Haplotaxida						
Naididae						
Paranais frici	-	-	-	-	-	-
Tubificidae						
Aulodrilus limnobius	-	-	-	-	-	-
Limnodrilus sp. §	86	215	-	-	86	-
Limnodrilus cervix	86	430	4133	-	-	-
Limnodrilus hoffmeisteri	1636	4306	41333	86	430	732
Potamothrix vejdovskyi	-	2583	-	-	-	-
Quistadrilus multisetosus	-	861	2067	-	-	904
UIW/OCC *	1464	7147	5517	43	129	818
UW/CC **	-	517	-	-	-	-
HIRUDINEA (Leeches)						
Erpobdellidae (unidentifiable)	-	43	-	-	-	-
Glossiphoniidae						
Helobdella stagnalis	-	-	-	-	-	-

§ =Developing penis sheaths were present in these individuals (most likely *Limnodrilus cervix* or *Limnodrilus hoffmeisteri*).
* =Unidentifiable immature without capilliform chaetae (mostly Tubificidae).
** =Unidentifiable immature with capilliform chaetae (mostly Tubificidae).

(Continued)

Table 78 (Concluded)

SPECIES	STATION 1	2	3	4	5	12a
ARTHROPODA						
DIPTERA						
Chaoboridae						
Chaoborus sp.	43	-	-	-	-	-
Chironomidae						
Tanypodinae						
Procladius sp.	-	-	-	-	-	-
Prodiamesinae						
Monodiamesa depectinata	-	-	-	-	-	-
Diamesinae						
Potthastia sp.	-	-	-	-	-	-
Chironominae						
Chironomus decorus	-	-	-	-	-	-
Demicryptochironomus sp.	-	-	-	-	-	-
adult Chironomidae	-	-	-	-	-	-
MOLLUSCA						
GASTROPODA (unident.)						
Hydrobiidae	-	-	-	43	-	-
Amnicola sp.	-	-	-	-	-	-
Planorbidae						
Gyraulus sp.	-	-	-	-	-	-
Valvatidae						
Valvata sp.	-	-	-	-	-	-
PELECYPODA						
Sphaeriidae (unident.)	689	-	-	-	172	-
Pisidium sp.	215	-	-	-	-	-
Sphaerium sp.	-	-	43	-	-	-

Table 79. Aquatic Macroinvertebrates [number/square meter] Collected from Stations 6, 7, 8, 9a, 10a, and 11, 3-4 and 19 May 88 (Source R1, Table 22) (see Figure 47)

SPECIES	STATION 6	7	8	9a	10a	11
COELENTERATA						
Hydroida						
Hydridae	172	344	86	86	431	86
ASCHELMINTHES						
NEMATODA (unident.)	-	431	-	301	215	215
ANNELIDA						
OLIGOCHAETA						
Haplotaxida						
Naididae						
Paranais frici	-	-	-	-	43	-
Tubificidae						
Aulodrilus limnobius	172	-	-	129	-	-
Limnodrilus sp. §	-	-	-	-	-	-
Limnodrilus cervix	-	-	-	-	-	-
Limnodrilus hoffmeisteri	43	-	517	-	474	215
Potamothrix vejdovskyi	129	-	4908	258	861	129
Quistadrilus multisetosus	-	-	-	-	-	86
UIW/OCC *	-	258	1033	3100	646	1206
UW/CC **	-	-	-	43	86	-
HIRUDINEA (Leeches)						
Erpobdellidae (unident.)	-	-	-	-	-	-
Glossiphoniidae						
Helobdella stagnalis	-	-	129	-	-	-

§ =Developing penis sheaths were present in these individuals (most likely *Limnodrilus cervix* or *Limnodrilus hoffmeisteri*).
* =Unidentifiable immature without capilliform chaetae (mostly Tubificidae).
** =Unidentifiable immature with capilliform chaetae (mostly Tubificidae).

(Continued)

Table 79 (Concluded)

SPECIES	6	7	8	9a	10a	11
	STATION					
ARTHROPODA						
DIPTERA						
Chaoboridae						
Chaoborus sp.	-	-	-	-	-	-
Chironomidae						
Tanypodinae						
Procladius sp.	-	-	-	86	-	43
Prodiamesinae						
Monodiamesa depectinata	-	-	-	129	-	129
Diamesinae						
Potthastia sp.	-	-	-	43	-	-
Chironominae						
Chironomus decorus	-	-	-	86	-	-
Demicryptochironomus sp.	-	-	-	86	-	-
adult Chironomidae	-	-	43	43	-	-
MOLLUSCA						
GASTROPODA (unident.)						
Hydrobiidae	-	43	-	43	86	-
Amnicola sp.	-	-	-	-	-	-
Planorbidae						
Gyraulus sp.	-	-	-	-	43	-
Valvatidae						
Valvata sp.	-	-	43	-	-	172
PELECYPODA						
Sphaeriidae (unident.)	-	-	-	86	-	86
Pisidium sp.	-	172	-	86	-	86
Sphaerium sp.	-	-	-	-	-	-

Table 80. Biomass [g/square meter] Wet Weight and Dry Weight, in Parentheses, of the Macroinvertebrates Collected from Indiana Harbor Stations 1-5 and 12a (Source R1, Table 24) (see Figure 47)

SPECIES	STATION 1	2	3	4	5	12a
COELENTERATA						
Hydroida						
Hydridae	-	-	-	-	.0043 (.####)	-
ASCHELMINTHES						
NEMATODA (unident.)	-	-	-	-	-	-
ANNELIDA						
OLIGOCHAETA (almost exclusively Tubificidae)	14.97 (3.272)	11.93 (3.208)	176.2 (44.73)	.2626 (.0904)	.8439 (.1894)	6.234 (1.666)
HIRUDINEA (Leeches)						
Erpobdellidae (unidentifiable)	-	-	-	-	-	.0474 (.0258)
Glossiphoniidae						
Helobdella stagnalis	-	-	-	-	-	-
ARTHROPODA						
DIPTERA						
Chironomidae larvae	-	-	-	-	-	-
Chironomidae pupae	-	-	-	-	-	-
MOLLUSCA						
GASTROPODA (unident.)						
Hydrobiidae	-	-	3.380 (1.981)	-	-	-
PELECYPODA						
Sphaeriidae (unident.)	.0430 (.0344)	-	147.9 (75.45)	-	3.720 (1.920)	-

Table 81. Biomass [g/square meter] Wet Weight and Dry Weight, in Parentheses, of the Macroinvertebrates Collected from Indiana Harbor Stations 6-8, 9a, 10a, and 11a Scurce R1, Table 25) (see Figure 47)

SPECIES	STATION 6	7	8	9a	10a	11
COELENTERATA						
Hydroida						
Hydridae	.0086 (.####)	-	.1206 (.0474)	-	.0301 (.0172)	-
ASCHELMINTHES						
NEMATODA (unident.)	-	.0043 (.####)	-	.0086 (.####)	.0086 (.####)	.0043 (.####)
ANNELIDA						
OLIGOCHAETA (almost exclusively Tubificidae)	.0172 (.0129)	.0043 (.####)	5.296 (1.274)	.8137 (.3401)	.3401 (.1292)	3.810 (.5468)
HIRUDINEA (Leeches)						
Glossiphoniidae						
Helobdella stagnalis	-	-	-	-	-	.0474 (.0258)
ARTHROPODA						
DIPTERA						
Chironomidae larvae	-	-	-	.5856 (.1550)	-	.0603 (.0215)
Chironomidae pupae	-	-	-	.0775 (.0172)	-	-
MOLLUSCA						
GASTROPODA						
Hydrobiidae	-	.4951 (.3272)	-	1.206 (.8353)		.7147 (.5037)
PELECYPODA						
Sphaeriidae (unident.)	-	.5769 (.4004)	-	1.296 (.5985)	.2885 (.1162)	1.033 (.5726)

Table 82. Aquatic Annelida Collected in the GCR-IHC [Designated by an *] (Source R1, Table 26)

ANNELIDA (true segmented worms)
ACLITELLATA
APHANONEURA
Aeolosomatidae
Aeolosoma sp.

CLITELLATA
OLIGOCHAETA (aquatic microdriles)
Glossoscolecidae
Sparganophilus tamesis Benham
Haplotaxida
Haplotaxidae
Haplotaxis gordioides (Hartmann)

Enchytraeidae spp.

Naididae
Amphichaeta sp.
Arcteonais lomondi (Martin)
Chaetogaster diaphanus (Gruithuisen)
Chaetogaster diastrophus (Gruithuisen)
Chaetogaster limnaei von Baer
Bratislavia unidentata (Harman)
Dero (Aulophorus) furcata (Müller)
Dero (Aulophorus) vaga (Leidy)
Dero (Dero) digitata (Müller)
Nais behningi (Michaelsen)
Nais barbata Müller
Nais bretscheri (Michaelsen)
Nais communis Piguet
Nais elinguis Müller
Nais pardalis Piguet
Nais pseudobtusa Piguet
Nais simplex Piguet
Nais variabilis Piguet
Ophidonais serpentina (Müller)
Paranais frici Hrabe *
Piguetiella michiganensis Hiltunen
Pristina breviseta Bourne
Pristinella jenkinae (Stephenson)
Pristina leidyi (Smith)
Slavina appendiculata (d'Udekem)
Specaria josinae (Vejdovsky)
Stylaria lacustris (Linnaeus)
Uncinais uncinata (Orsted)
Vejdovskiella intermedia (Bretscher)

(Continued)

Table 82 (Concluded)

Tubificidae
Aulodrilus americanus Brinkhurst & Cook
Aulodrilus limnobius Bretscher *
Aulodrilus pigueti Kowalewski
Aulodrilus pluriseta (Piguet)
Branchiura sowerbyi Beddard
Ilyodrilus templetoni (Southern)
Isochaetides freyi (Brinkhurst)
Limnodrilus angustipenis Brinkhurst & Cook
Limnodrilus cervix Brinkhurst *
Limnodrilus cervix variant
Limnodrilus claparedianus Ratzel
Limnodrilus hoffmeisteri Claparède *
Limnodrilus hoffmeisteri variant
Limnodrilus hoffmeisteri form *spiralis*
Limnodrilus maumeensis Brinkhurst & Cook
Limnodrilus maumeensis variant
Limnodrilus profundicola (Verrill)
Limnodrilus udekemianus Claparède
Potamothrix bavaricus (Oschmann)
Potamothrix bedoti (Piguet)
Potamothrix hammoniensis (Michaelsen)
Potamothrix moldaviensis Vejdovsky & Mrazek
Potamothrix vejdovskyi (Hrabe) *
Quistadrilus multisetosus (Smith) * (two subspecies recognized; see text for explanation)
Rhyacodrilus coccineus (Vejdovsky)
Rhyacodrilus montana (Brinkhurst)
Spirosperma ferox Eisen
Spirosperma nikolskyi (Lastockin & Sokolskaya)
Tasserkidrilus kessleri (Hrabe)
Tasserkidrilus superiorensis (Brinkhurst & Cook)
Tubifex ignotus (Stolc)
Tubifex tubifex (Müller)

Lumbriculida
Lumbriculidae
Lumbriculus variegatus (Müller)
Stylodrilus heringianus Claparède

HIRUDINEA (leeches)
Erpobdellidae
Erpobdella punctata (Leidy)

Glossiphoniidae
Helobdella elongata (Castle)
Helobdella stagnalis (Linnaeus) *

† = Records from MSDGC (1975, 1977a, 1977b) Stimpson *et al.* (1975), Whitley and Wetzel (1976), Mozley and Howmiller (1977), Spencer (1980), and Wetzel (1989). Phylogeny follows Brinkhurst (1986).

Table 83. Phytoplankton Identified from Indiana Harbor and Canal (Source R1, Appendix 1)

Area	Dominant taxa (in order of relative abundance)	Comments
Q (small sample)	*Fragilaria crotonensis* *Tabellaria fenestrata* *Synedra ulna* *Asterionella formosa* *Melosira varians/Spirulina* (?) sp.	Diatoms were very abundant. The sample was dominated by smaller taxa and was not very diverse.
R (small sample)	*Tabellaria fenestrata* *Asterionella formosa* *Fragilaria crotonensis* *Synedra ulna* *Melosira varians*	Sample was dominated by filamentous/colonial diatoms and was not very diverse.
T (large sample)	*Tabellaria fenestrata* *Fragilaria crotonensis* *Synedra ulna* *Asterionella formosa* *Oscillatoria* sp.	The sample was numerically dominated by diatoms. Several different algalgroups were observed, making the sample relatively diverse.

Table 84. Periphyton Identified from Indiana Harbor and Canal (Source R1, Appendix 2)

Area	Dominant taxa (in order of relative dominance)	Comments
R (begin.)	*Oscillatoria/Lyngbya* sp. *Tabellaria fenestrata* *Synedra ulna* *Achnanthes* sp. *Melosira* sp.	Sample was not very diverse.
R (end)	*Cladophora* sp. (*glomerata*) *Rhoicosphenia curvata* *Achnanthes* sp. *Synedra ulna* *Lyngbya* sp./*Oscillatoria* sp.	*Cladophora* was the most abundant filamentous alga and most American forms are assigned to the species *glomerata*. Sample was also dominated by diatoms.

Table 85. Summary of Fish Species Collected in Indiana Harbor (Source R1, Table 20)

Species	Common name	1983[a]	1984[b]	1988[c]
Alosa pseudoharengus	Alewife	x	x	x
Dorosoma cepedianum	Gizzard shad	x	x	x
Umbra limi	Central mudminnow	x	x	
Carassius auratus	Goldfish	x	x	x
Cyprinus carpio	Carp	x	x	x
C. auratus x *C. carpio*	hybrid	x	x	
Notemigonus crysoleucas	Golden shiner	x	x	x
Notropis atherinoides	Emerald shiner	x	x	x
Notropis hudsonius	Spottail shiner	x	x	
Pimephales notatus	Bluntnose minnow	x	x	
Pimephales promelas	Fathead minnow	x	x	
Lepomis gibbosus	Pumpkinseed	x	x	
Lepomis macrochirus	Bluegill	x	x	
Pomoxis nigromaculatus	Black crappie	x	x	
Perca flavescens	Yellow perch	x	x	x
Salmo gairdneri	Rainbow trout		x	
Salmo trutta	Brown trout		x	
Salvenlinus namaycush	Lake trout		x	
Oncorhynchus tsawytscha	Chinook salmon		x	
Osmerus mordax	Rainbow smelt		x	
Catostomus commersoni	White sucker		x	
Ambloplites rupestris	Rock bass		x	
Lepomis cyanellus	Green sunfish		x	
Micropterus dolomieui	Small mouth bass			
Etheostoma nigrum	Johnny darter			x
Cottus bairdi	Mottled sculpin			x
Lepomis (Hybrid)	Sunfish (Bluegill x Pumpkinseed?)			x

[a]USEPA 1985
[b]USACE 1986
[c]Current study

Table 86. Vertebrate Wildlife Observed During Grand Calumet River Field Trip, 24-27 Jun 86 (Source R38)

VERTEBRATE WILDLIFE *OBSERVED DURING
GRAND CALUMET RIVER FIELD TRIP (June 24-27,'86)

	<5	5 - 15	>15
FISH			
Carp			X
Golden Shiner			X
Goldfish			X
Redear Sunfish	(1)		
REPTILES			
Painted Turtle	X		
AMPHIBIANS			
(None)			
MAMMALS			
Muskrat		X (many dens were observed)	

*Birds are in separate list

Table 87. Preliminary List of Vegetation in the Grand Calumet River Area (Source R38)

Dominant Vegetation	
Cattail	*Typha domingensis* (Typhaceae)
Reed Grass	*Phragmites cummunis* (Gramineae)
Water Plantain	*Sagittaris* sp. (Alismaceae)
Lemna sp. (duckweed) in stagnant marsh areas and coves.	
Occasionals	
Pondweed	*Potamogeton* sp. (Najadaceae)
Water milfoil	*Myriophyllum* sp. (Haloragidaceae)

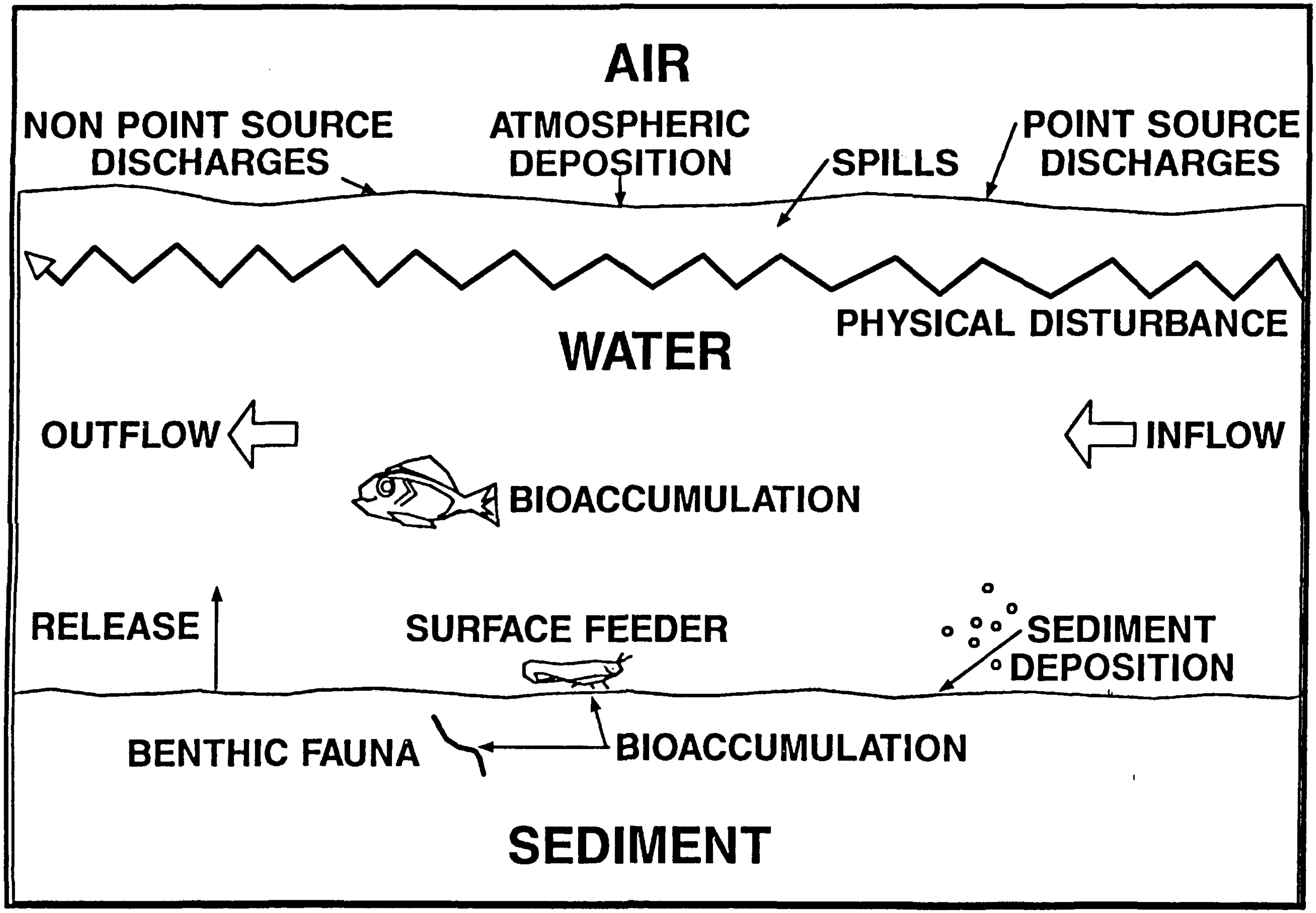


Figure 1. Contaminant migration pathways for evaluation of in-place contaminated sediments

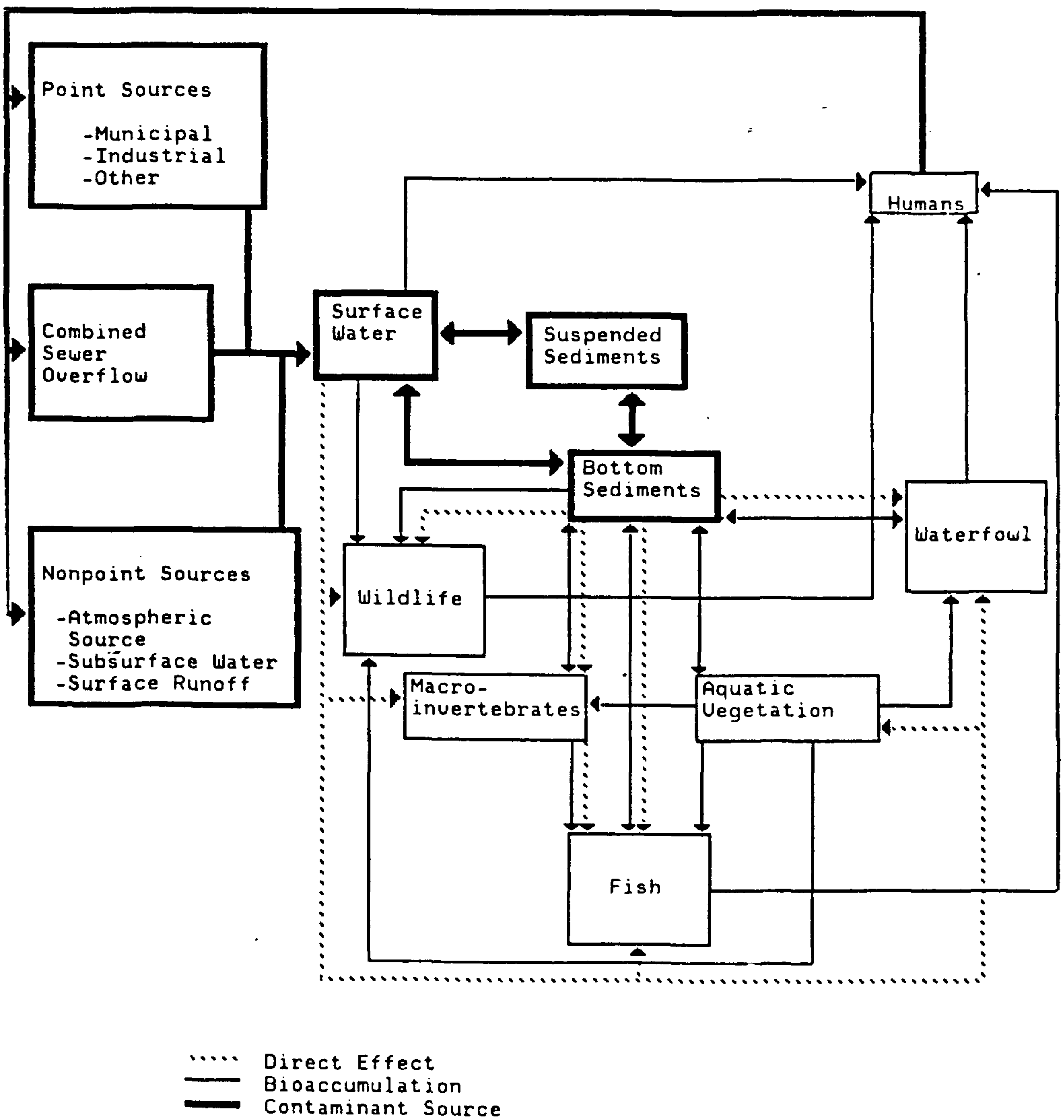


Figure 2. Movement of chemicals in the GCR-IHC ecosystem (Source P10)

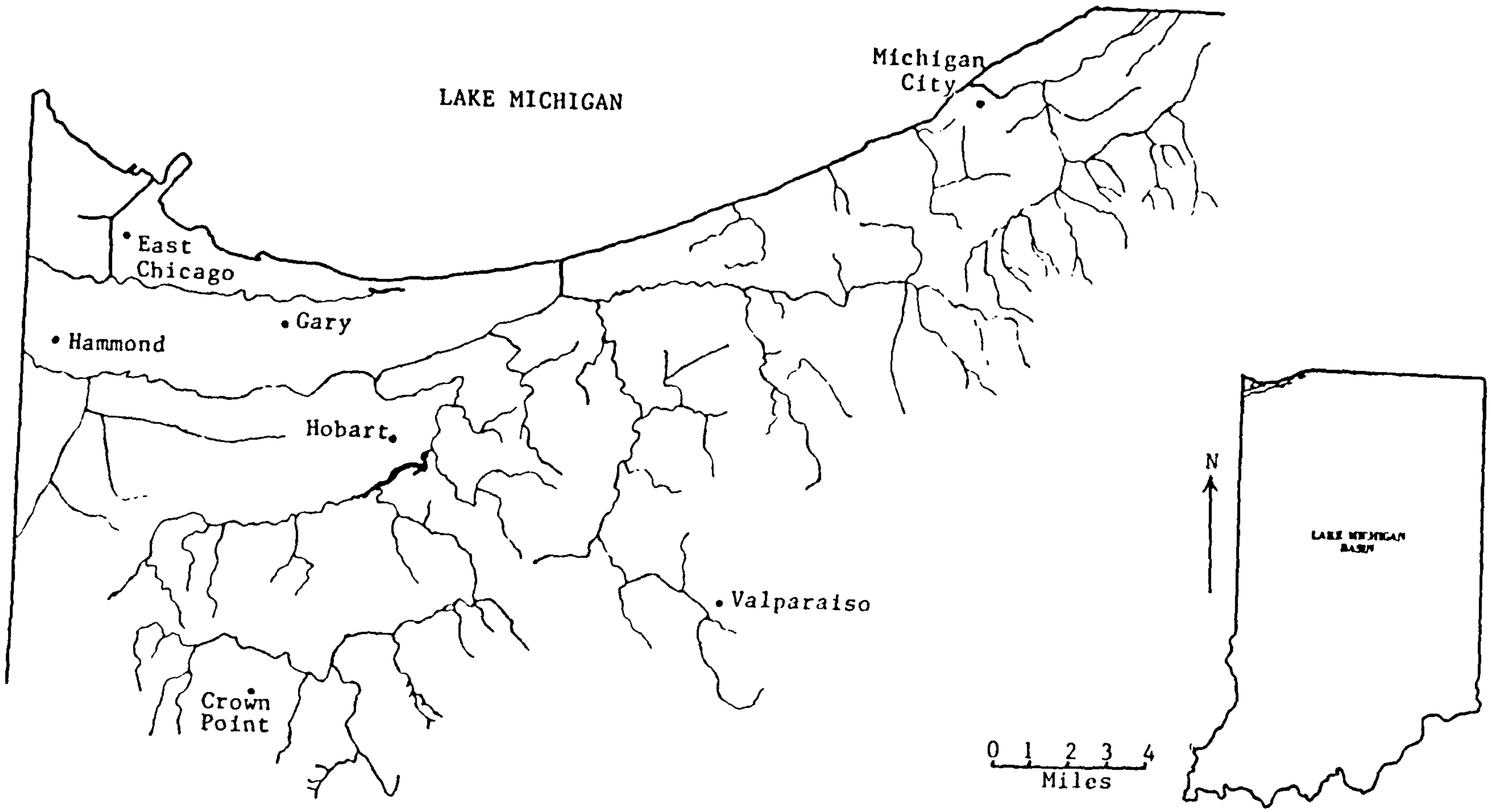


Figure 3. General location of the Grand Calumet River AOC (Source R11, Figure 8)

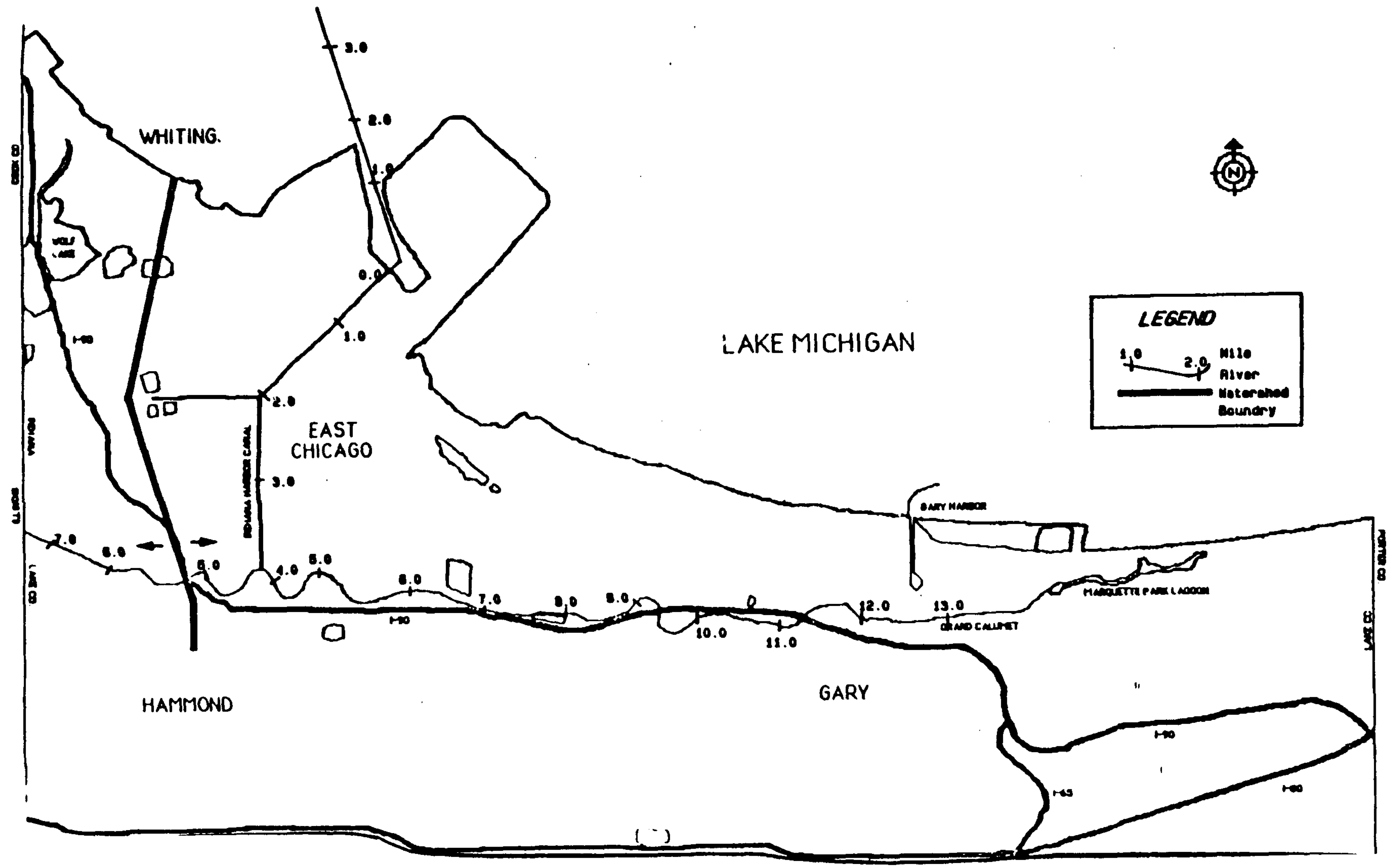


Figure 4. Grand Calumet River AOC boundaries (Source R15, Figure 2-1)

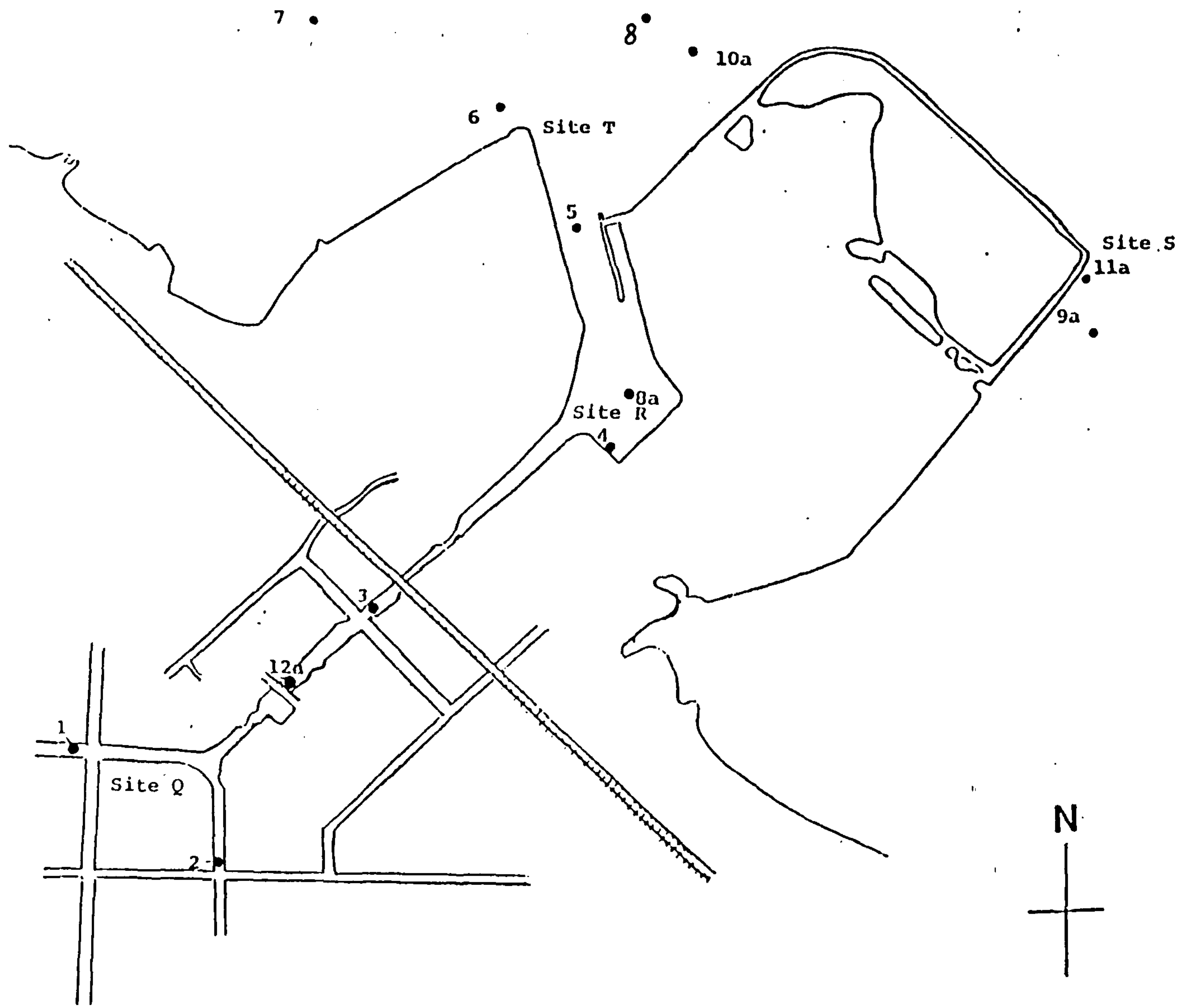


Figure 5. Location of sediment sampling stations in Indiana Harbor (Source R1, Figure 1) (see Tables 6-13)

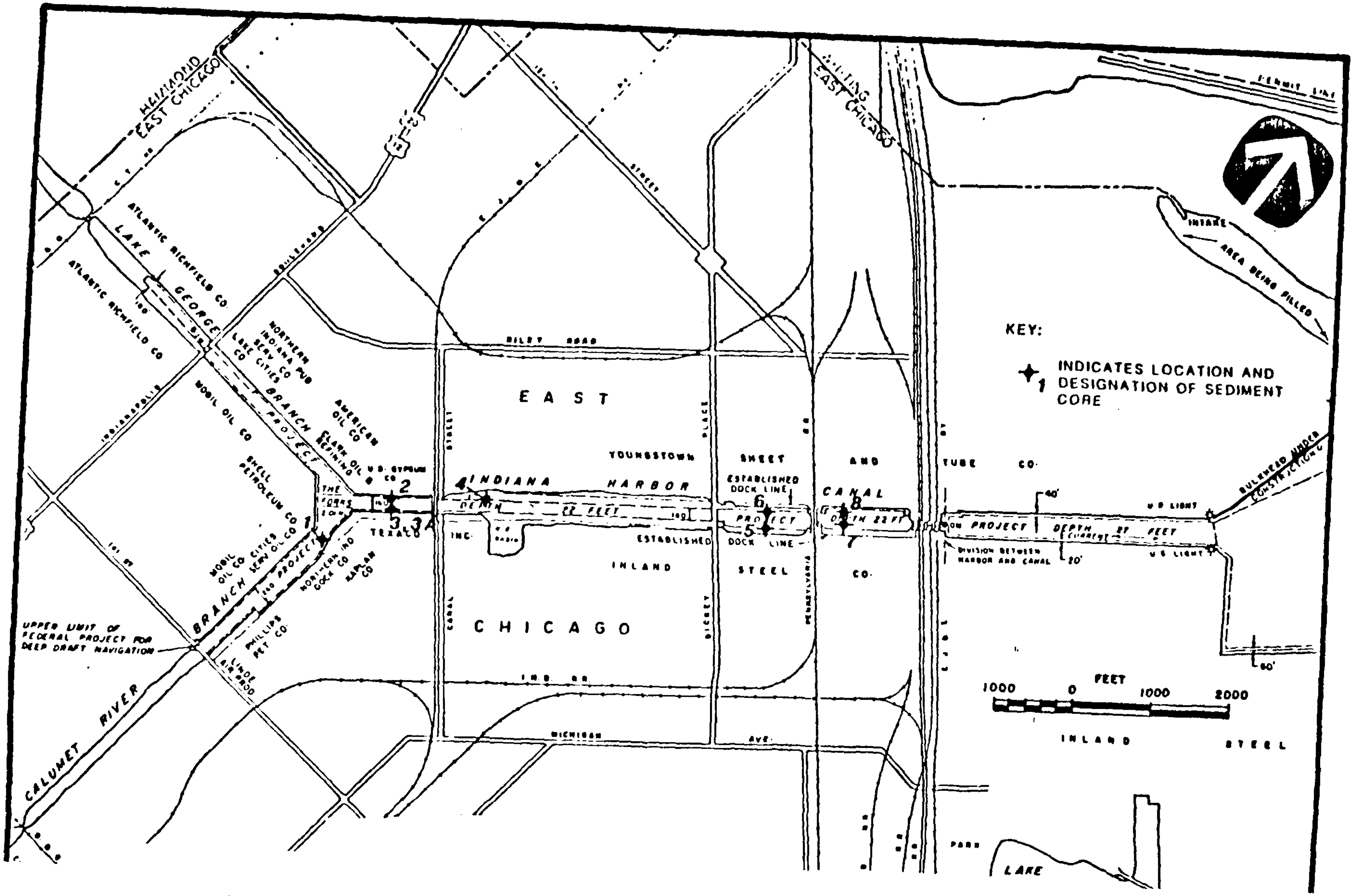
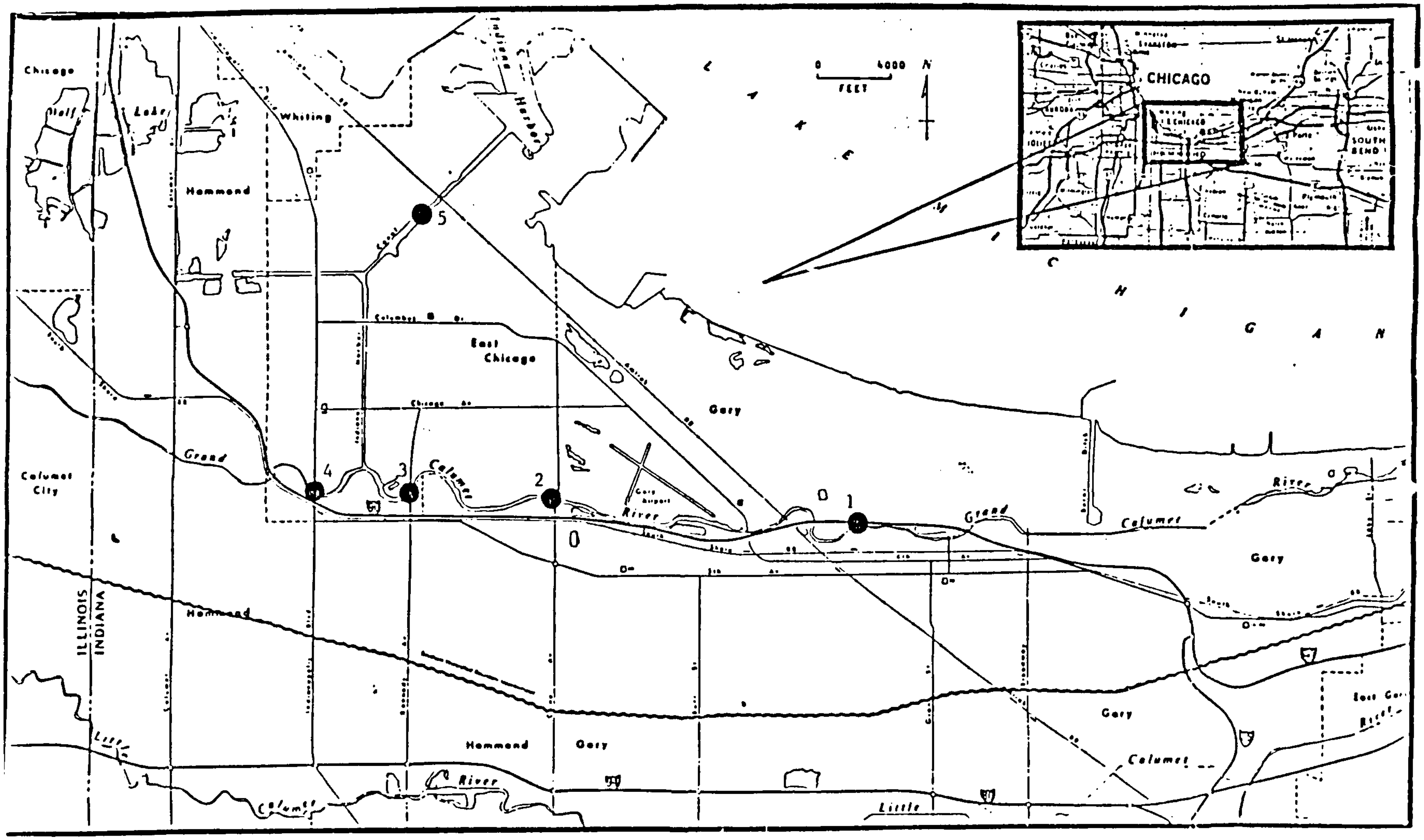


Figure 6. Location of sediment sampling stations in the Indiana Harbor Canal (Source R7, Plate 3)



● Indiana Department of Environmental Management Sampling Sites

Figure 7. Location of sediment sampling stations in Indiana Harbor and the Grand Calumet River - IDEM (Source P10) (see Table 20)

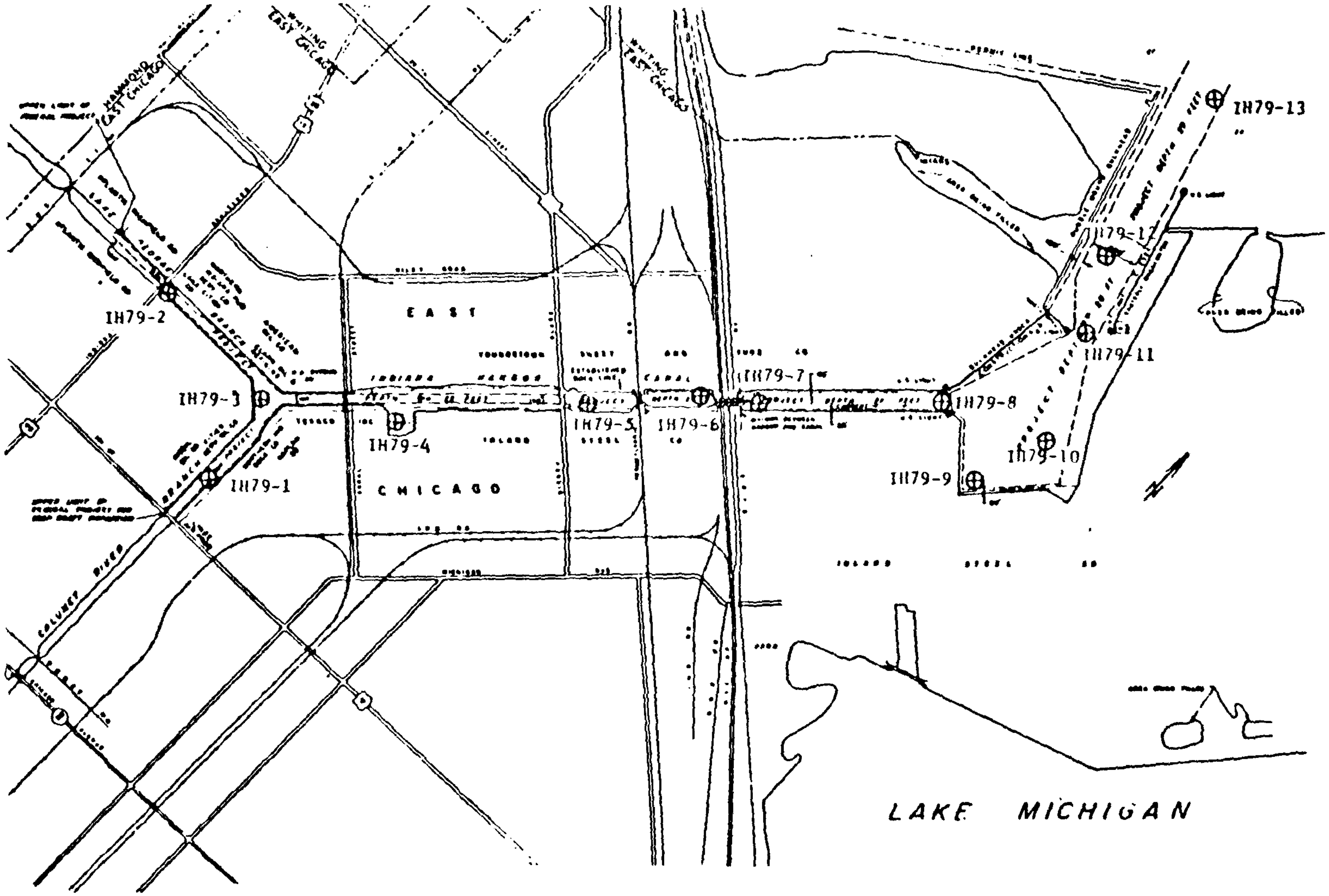
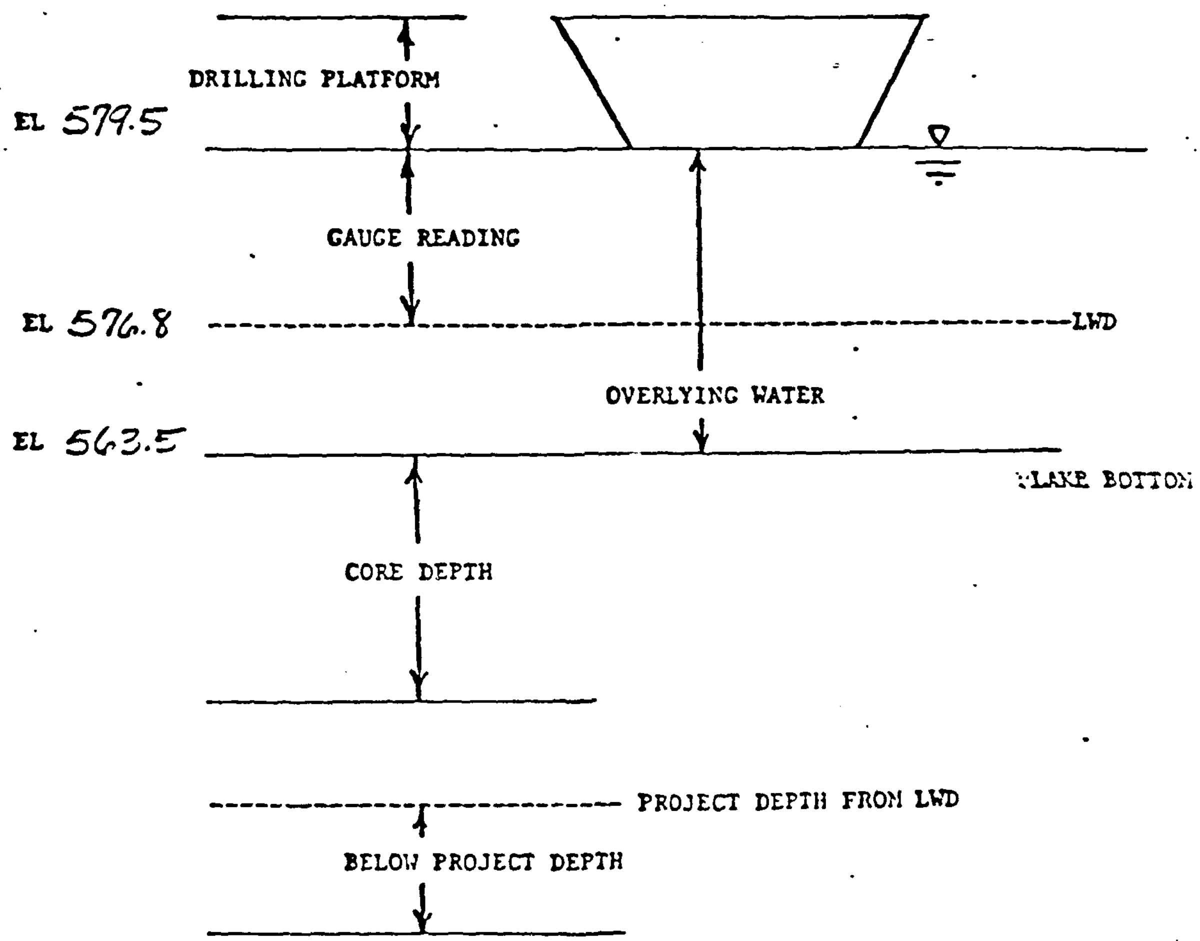


Figure 8. Location of sediment sampling stations in Indiana Harbor and Canal - Reference 10 (Source R10, Incl. 1) (see Table 23)

SAMPLE LOCATION WORKSHEET



SITE LOCATION	GAUGE READING	DRILLING PLATFORM	OVERLYING WATER	PROJECT DEPTH LWD FT	DEPTH IN SEDIMENT TO PROJECT DEPTH-FT	CORE DEPTH FT	NO. OF SAMPLES
CDH-2-79	2.7	9.0	16	23.3	10.0	10.0	12

Figure 9. Example sample location worksheet (Source R10, Plate 15)

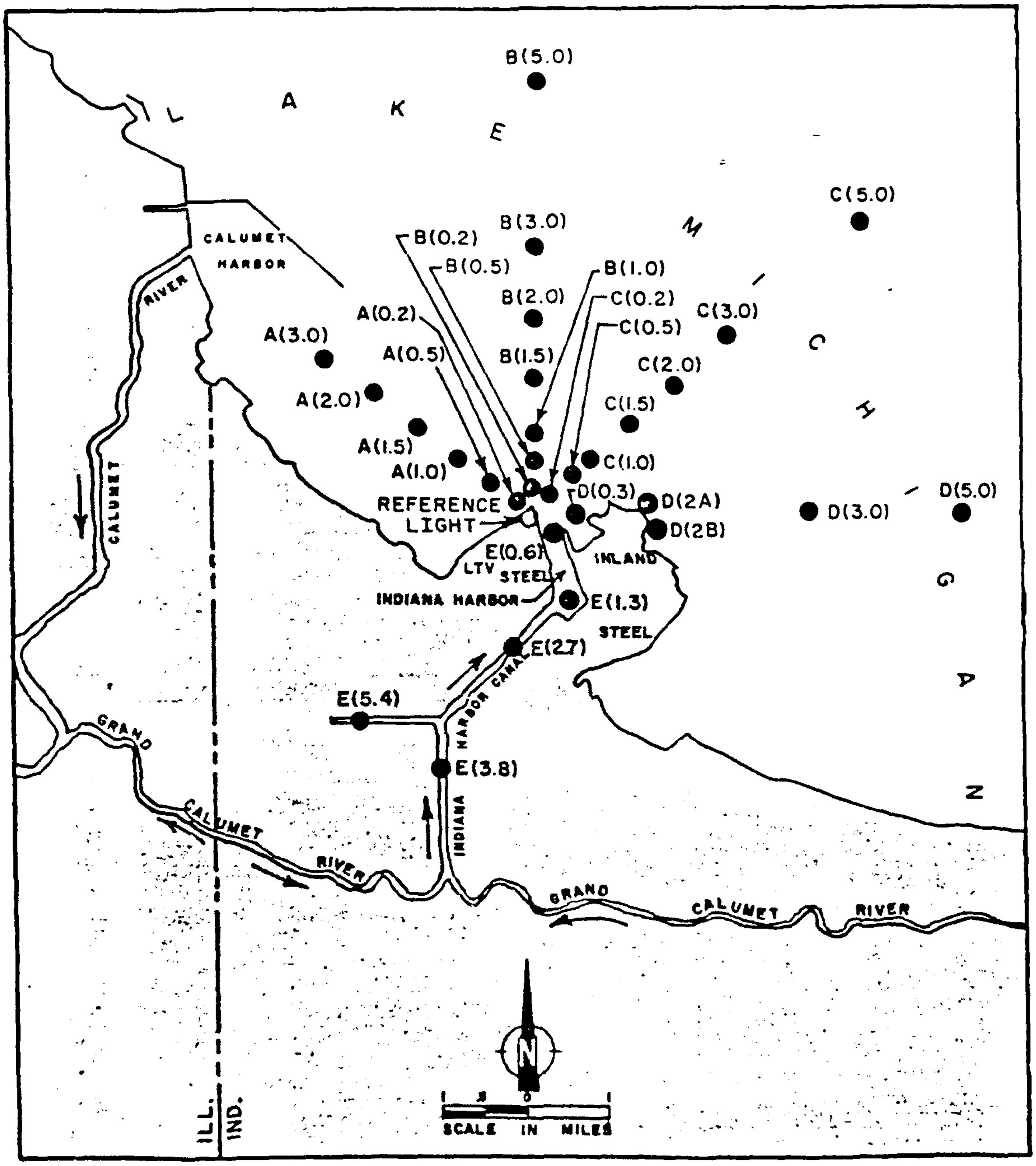


Figure 10. Location of sampling transects (Source R5, Figure 1) (see Table 19)

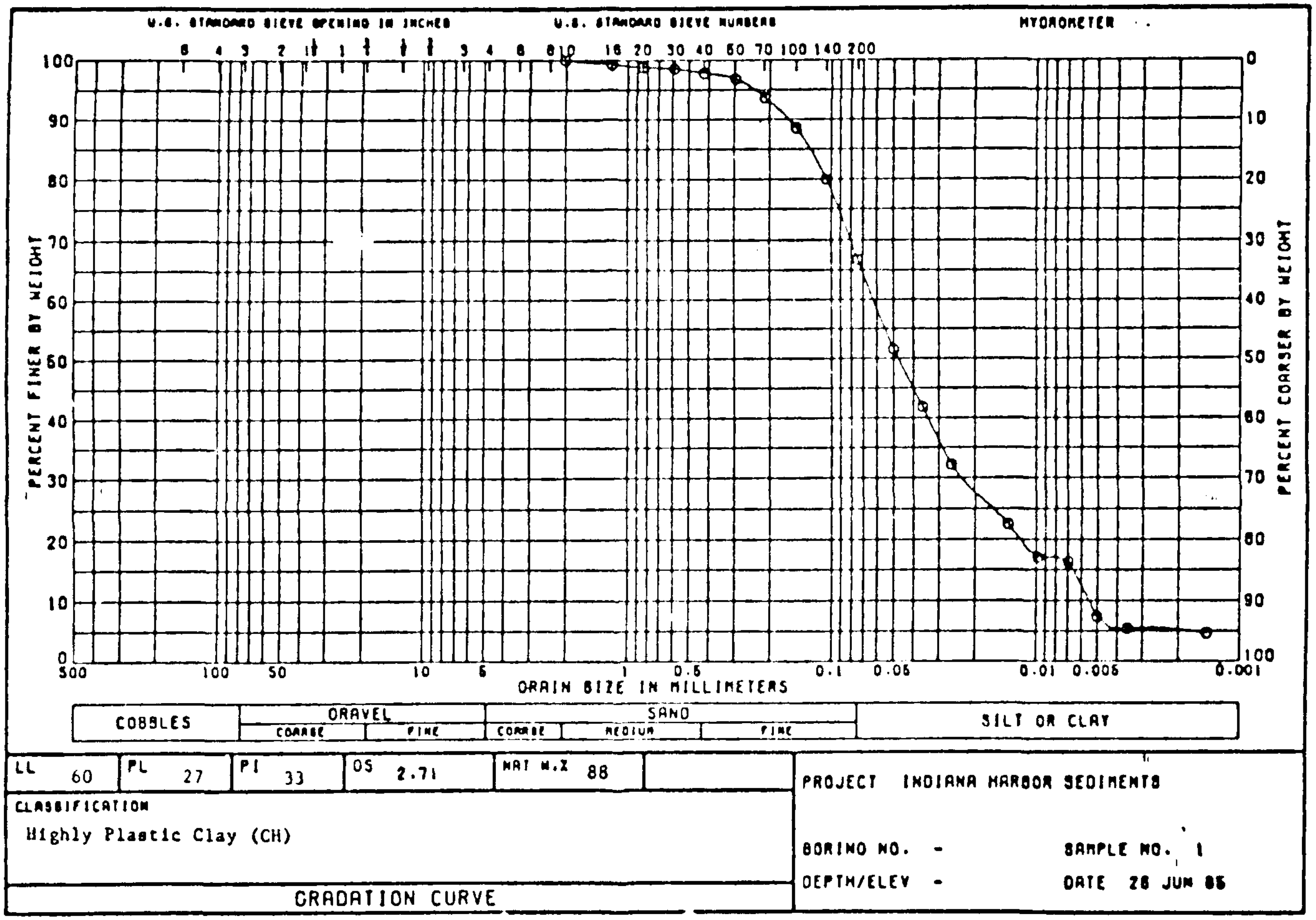


Figure 11. Grain size distribution for Indiana Harbor sediment (Source R24, Figure 5)

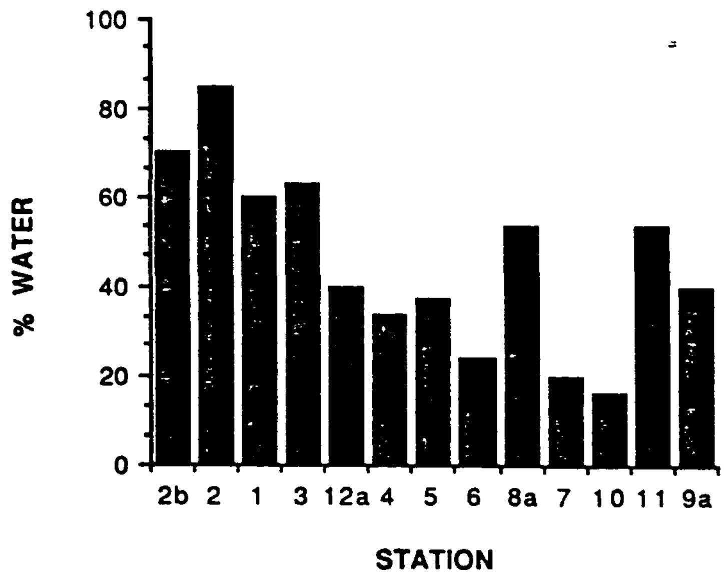


Figure 12. Histogram showing percent water in Indiana Harbor sediments (Source R1, Figure 2) (see also Figure 5)

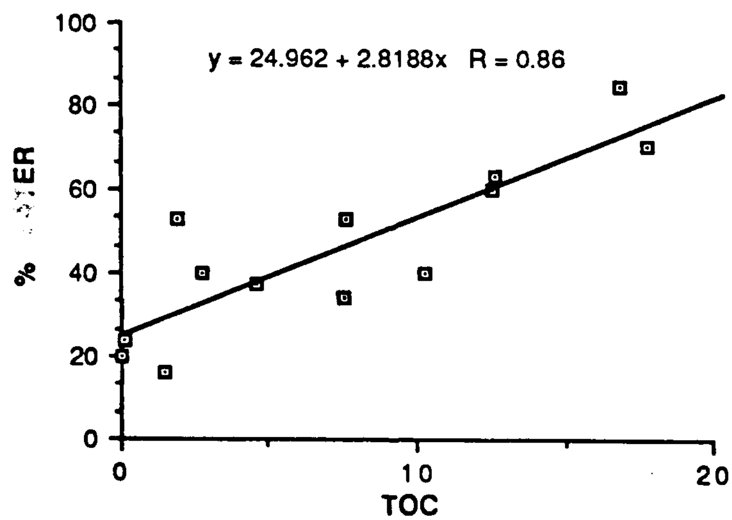


Figure 13. Scatterplot of percent water versus total organic carbon (TOC mg/kg) in Indiana Harbor sediments (Source R1, Figure 3)

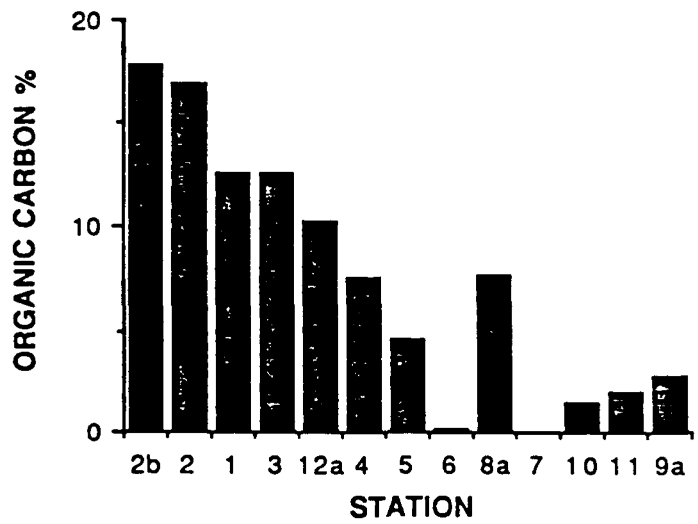


Figure 14. Histogram showing total organic carbon (mg/kg) at sediment sampling stations (Source R1, Figure 4) (see also Figure 5)

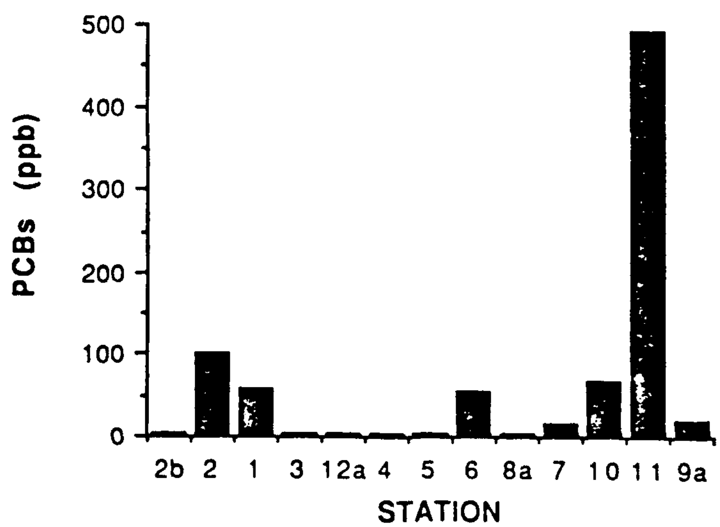


Figure 15. Total PCB concentrations (ppb) in sediment samples from Indiana Harbor (Source R1, Figure 6) (see also Figure 5)

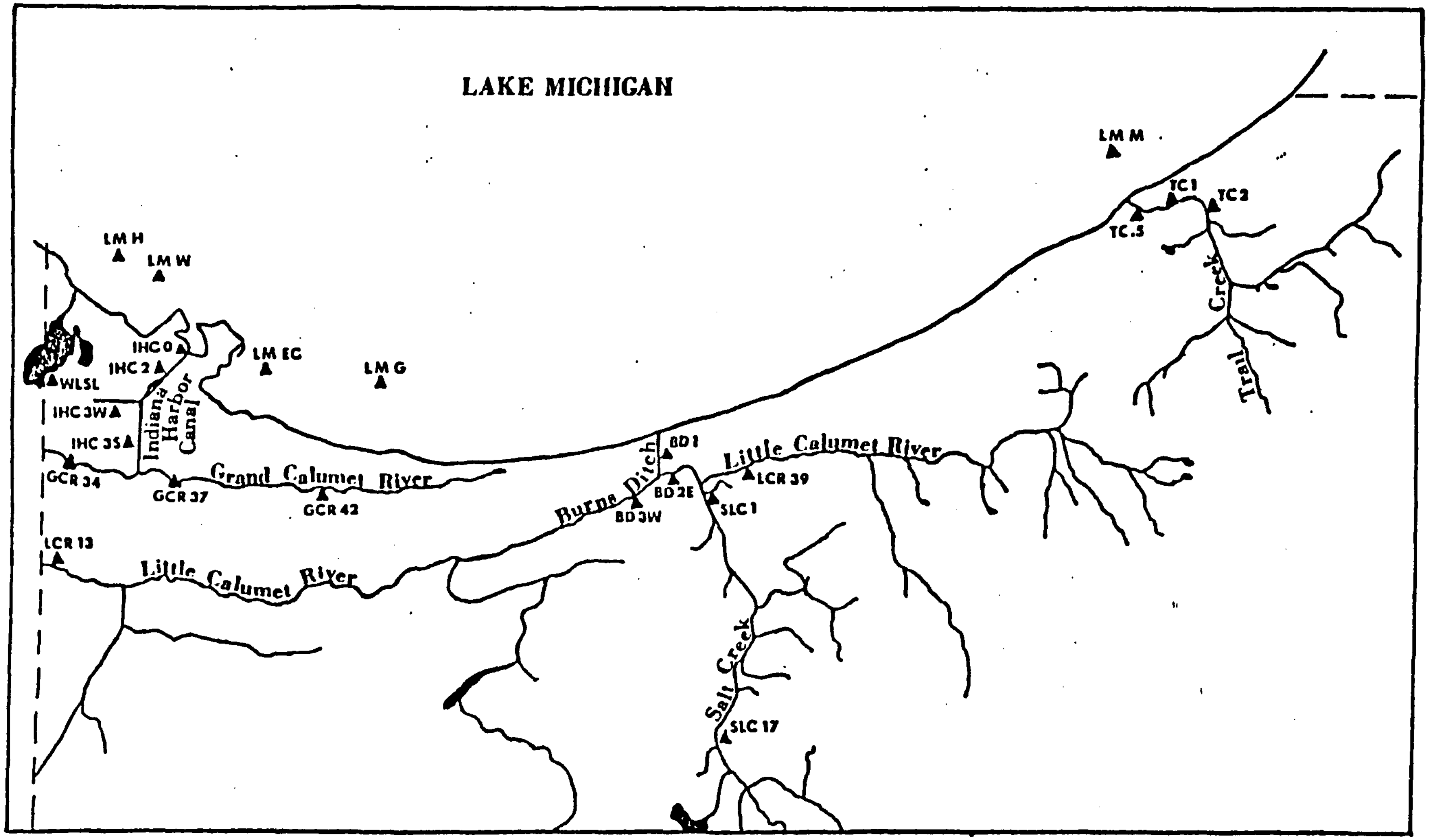


Figure 16. Location of Indiana fixed water quality monitoring stations in the AOC (Source R22, Figure 2.2) (see Table 29)

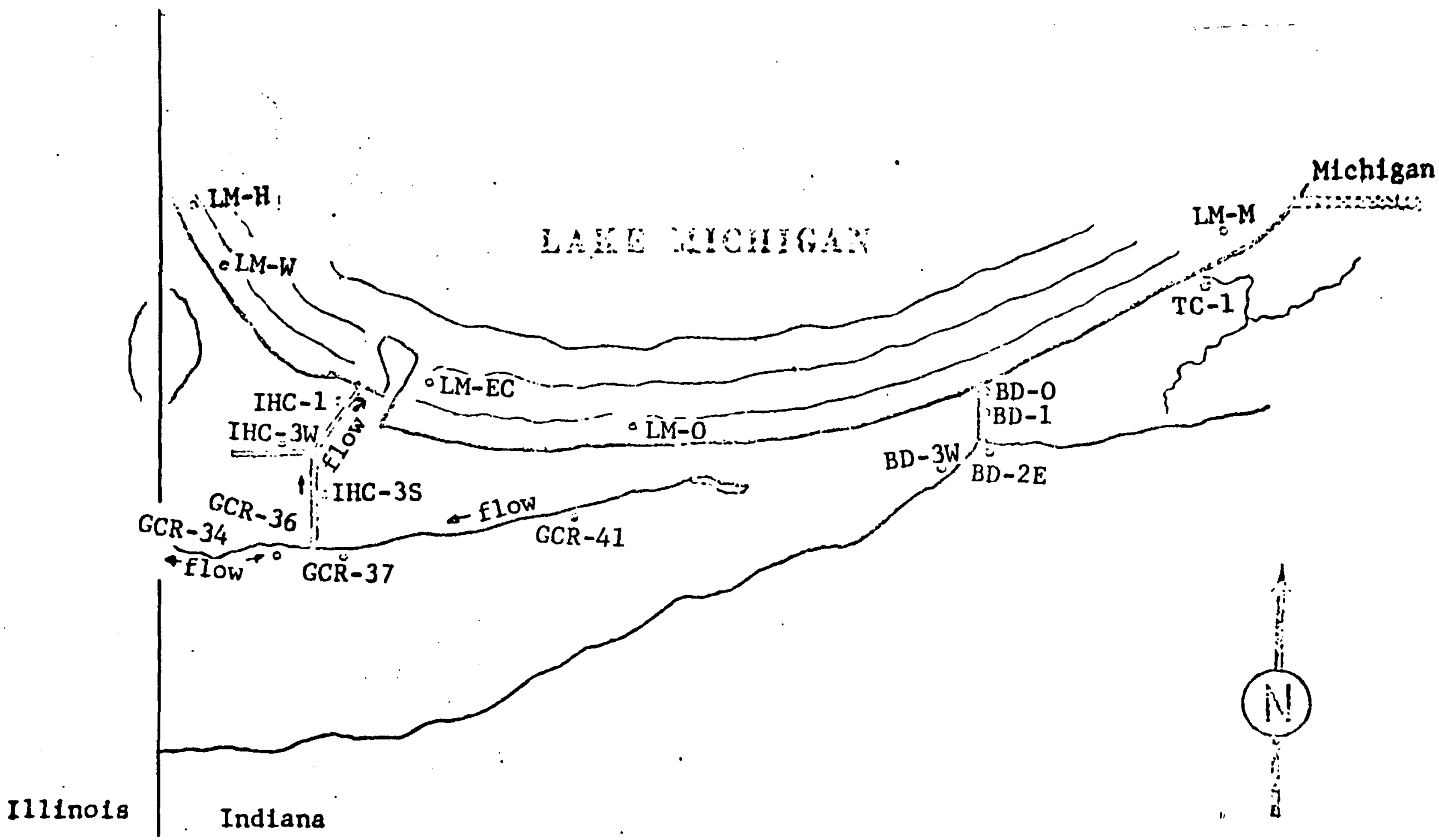


Figure 17. Indiana water quality monitoring stations in the GCR-IHC area (Source R18, Figure 6.2) (see Table 29)

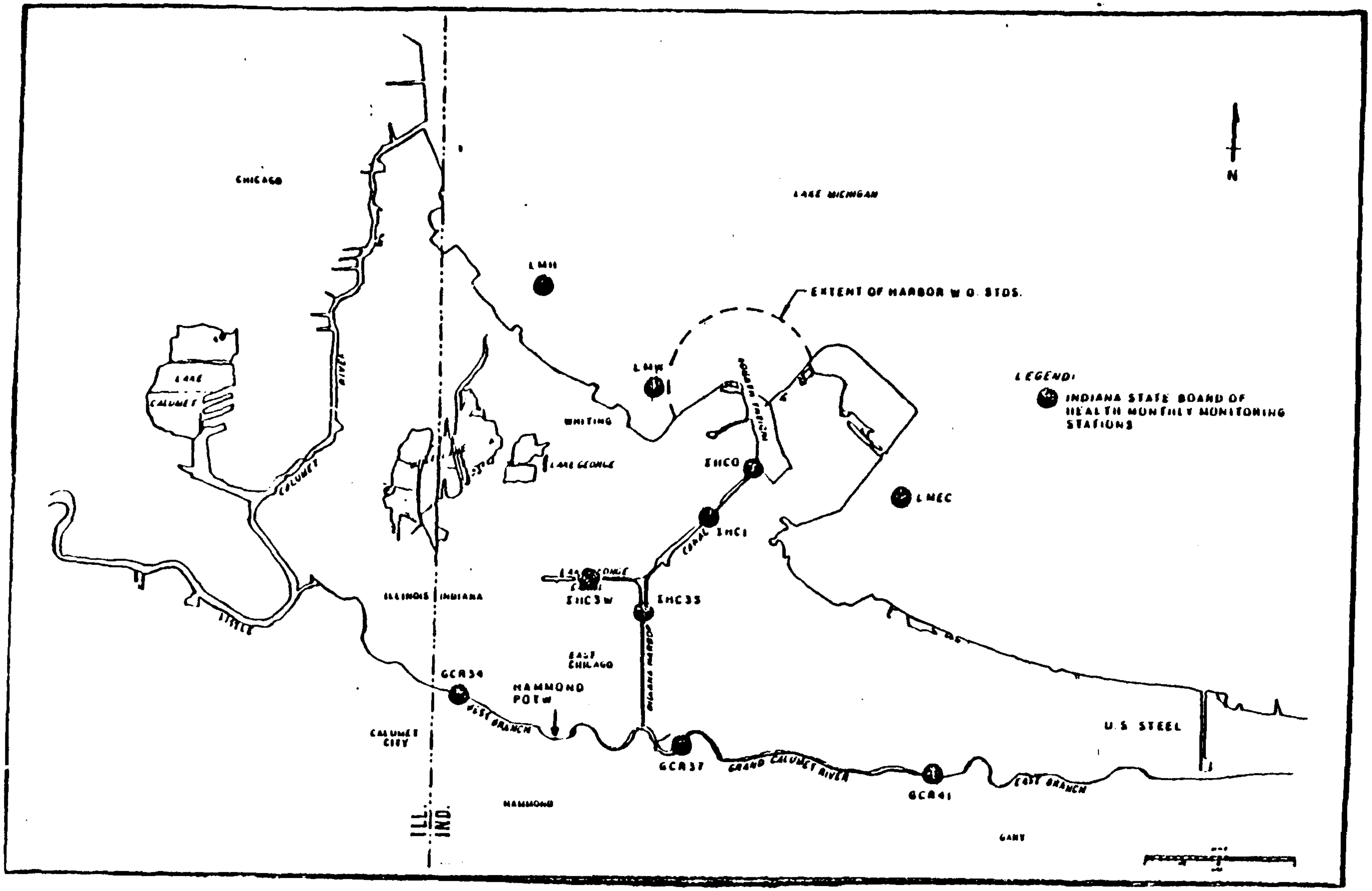


Figure 18. Locations of ISBH monthly water quality monitoring stations
(Source R13, Figure 2-4)

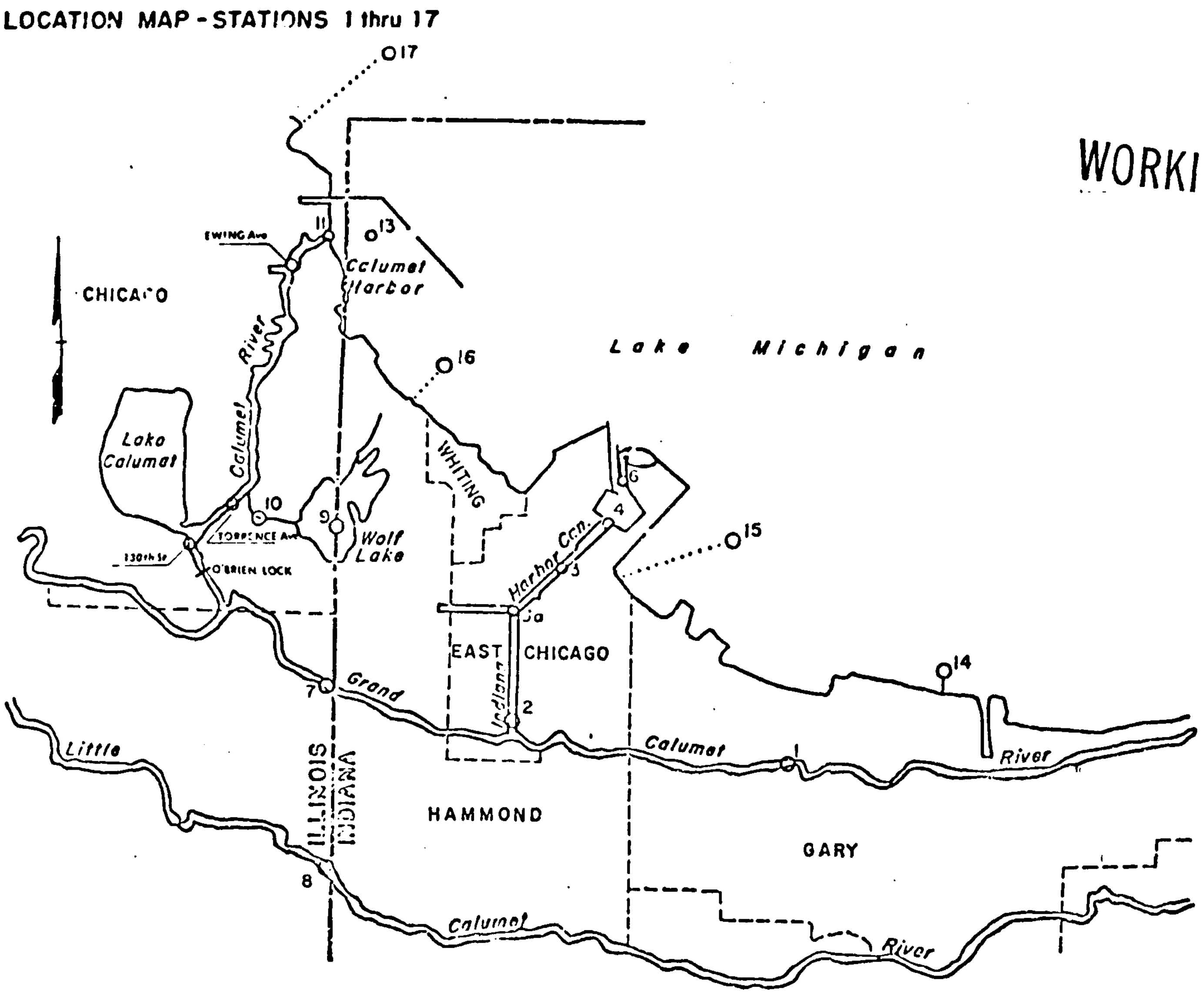


Figure 19. Locations of USEPA water quality monitoring stations CAL01-CAL17 (Source R18, Figure 1.6)

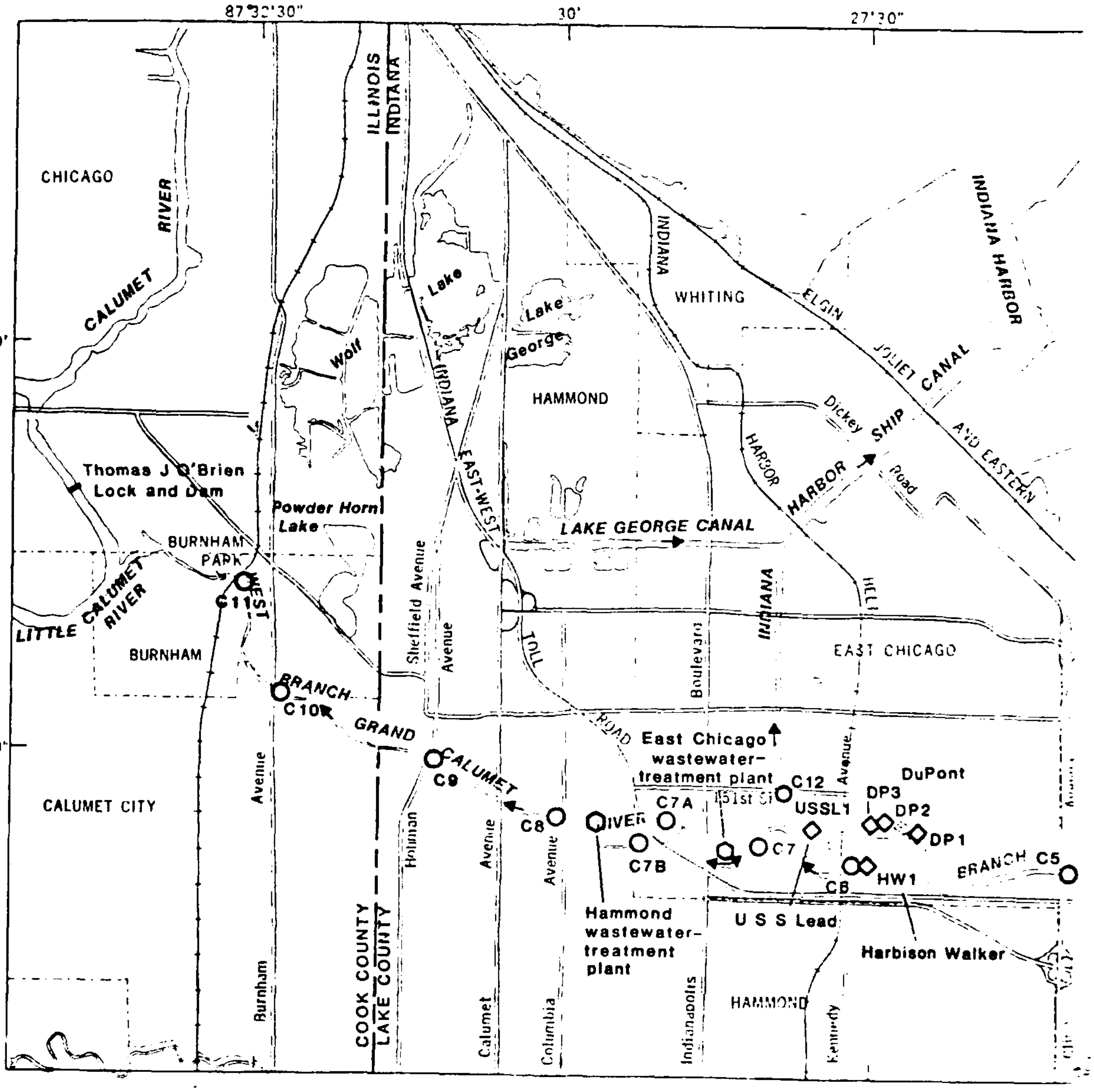


Figure 20a. Locations of USGS water quality monitoring stations (Source R12, Figure 1) (see Tables 31-33)

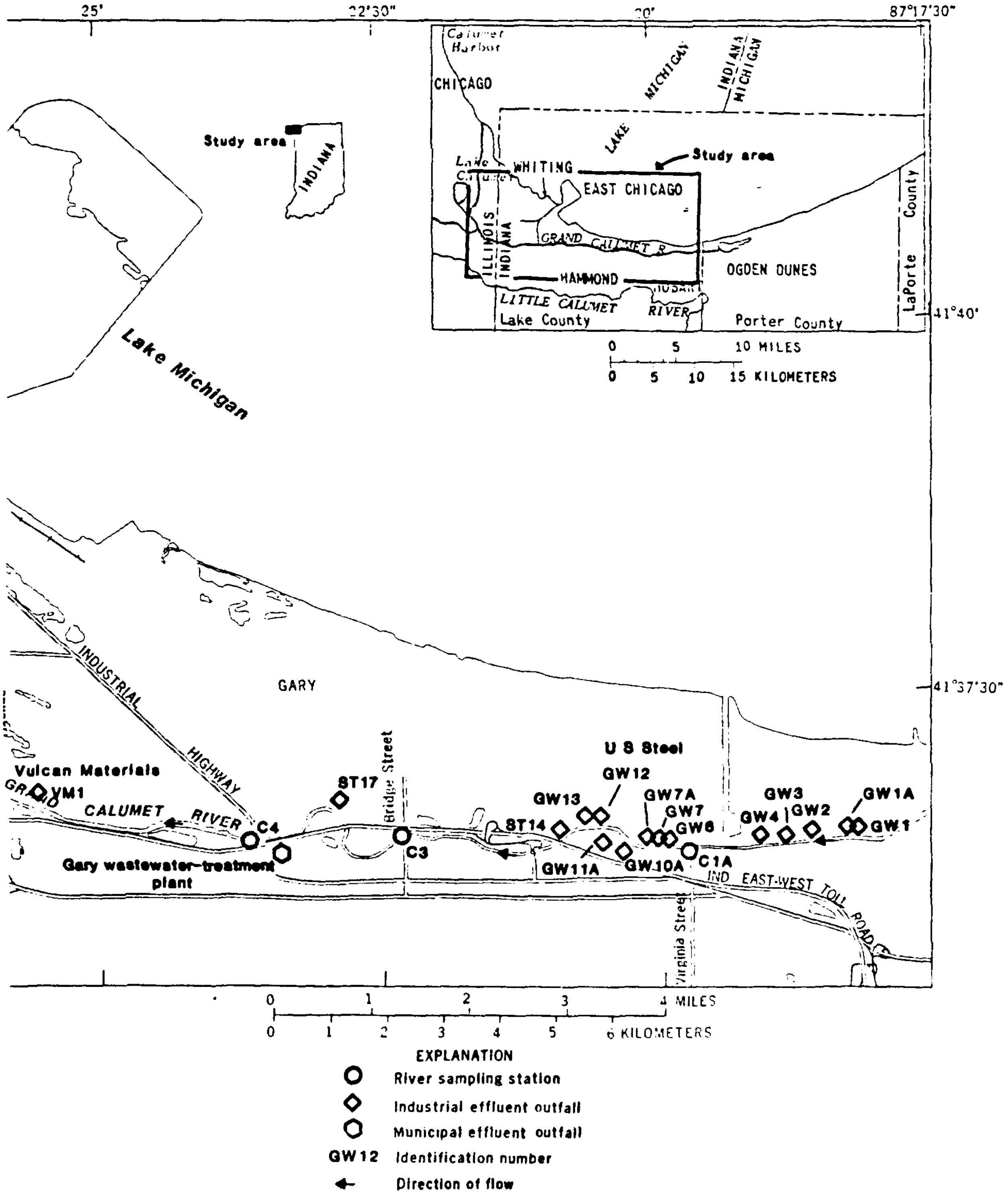


Figure 20b. Locations of USGS water quality monitoring stations Source R12, Figure 1) (see Tables 31-33)

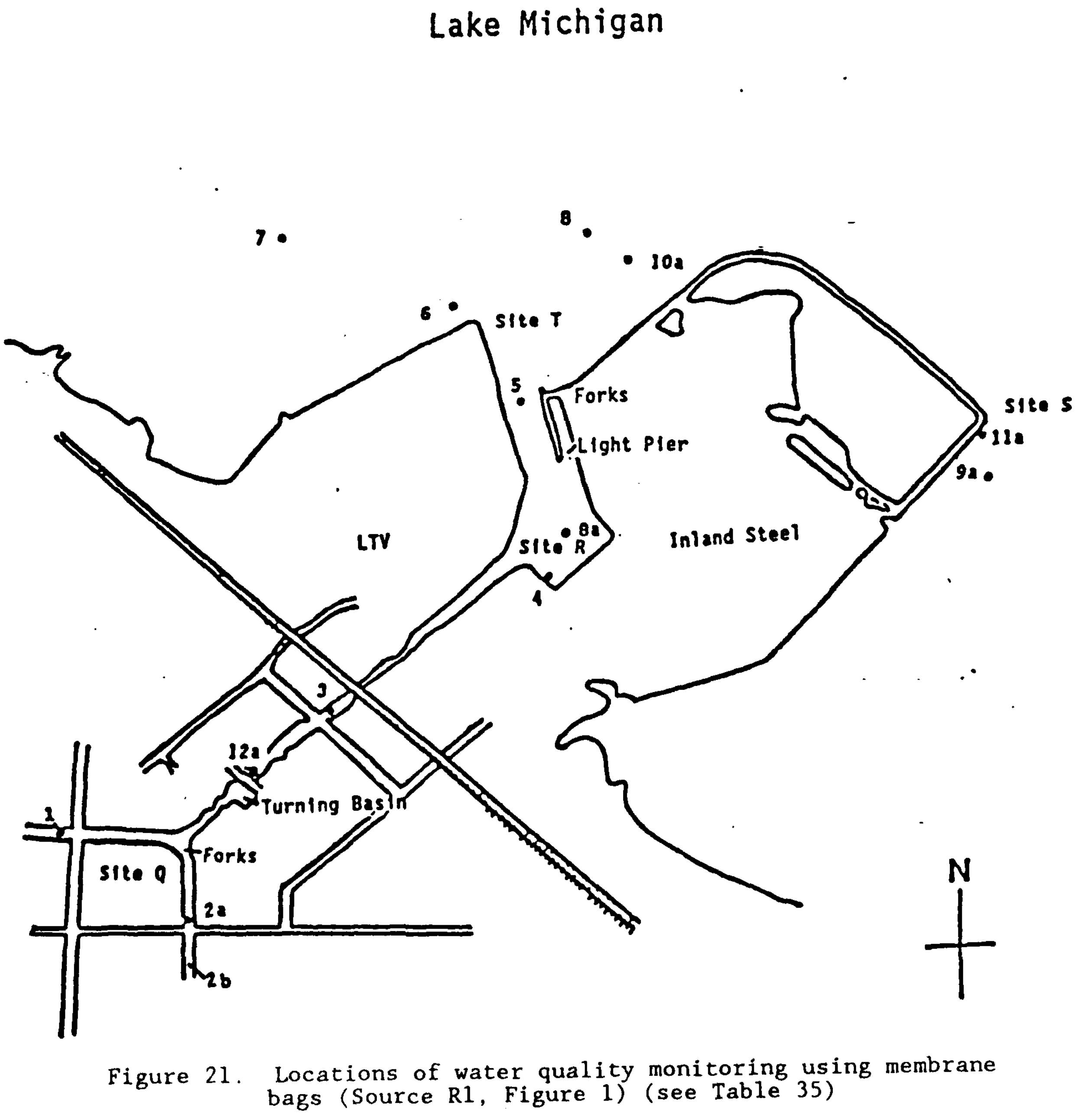


Figure 21. Locations of water quality monitoring using membrane bags (Source R1, Figure 1) (see Table 35)

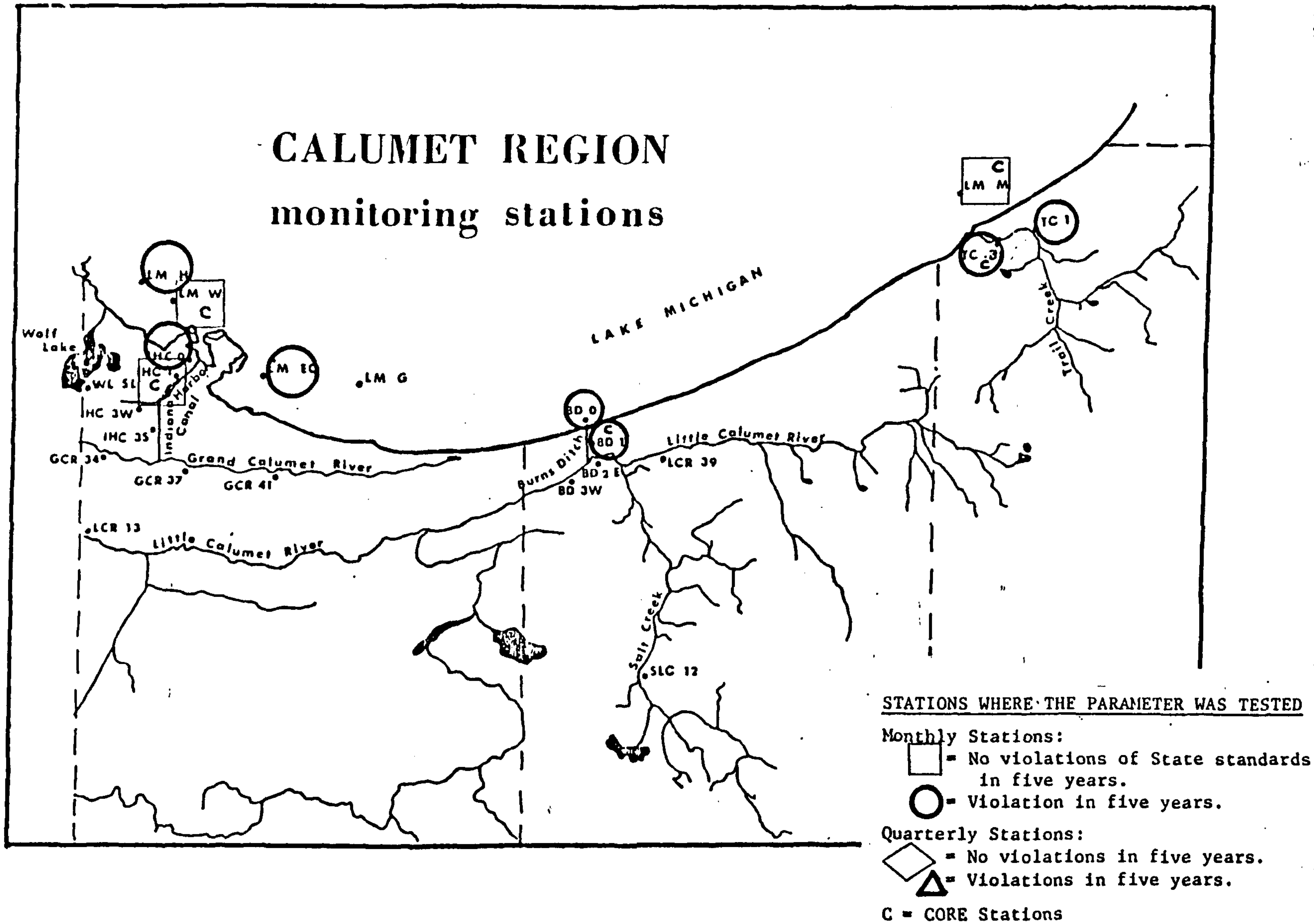


Figure 22. IDEM water quality monitoring report - cadmium (Source 22)

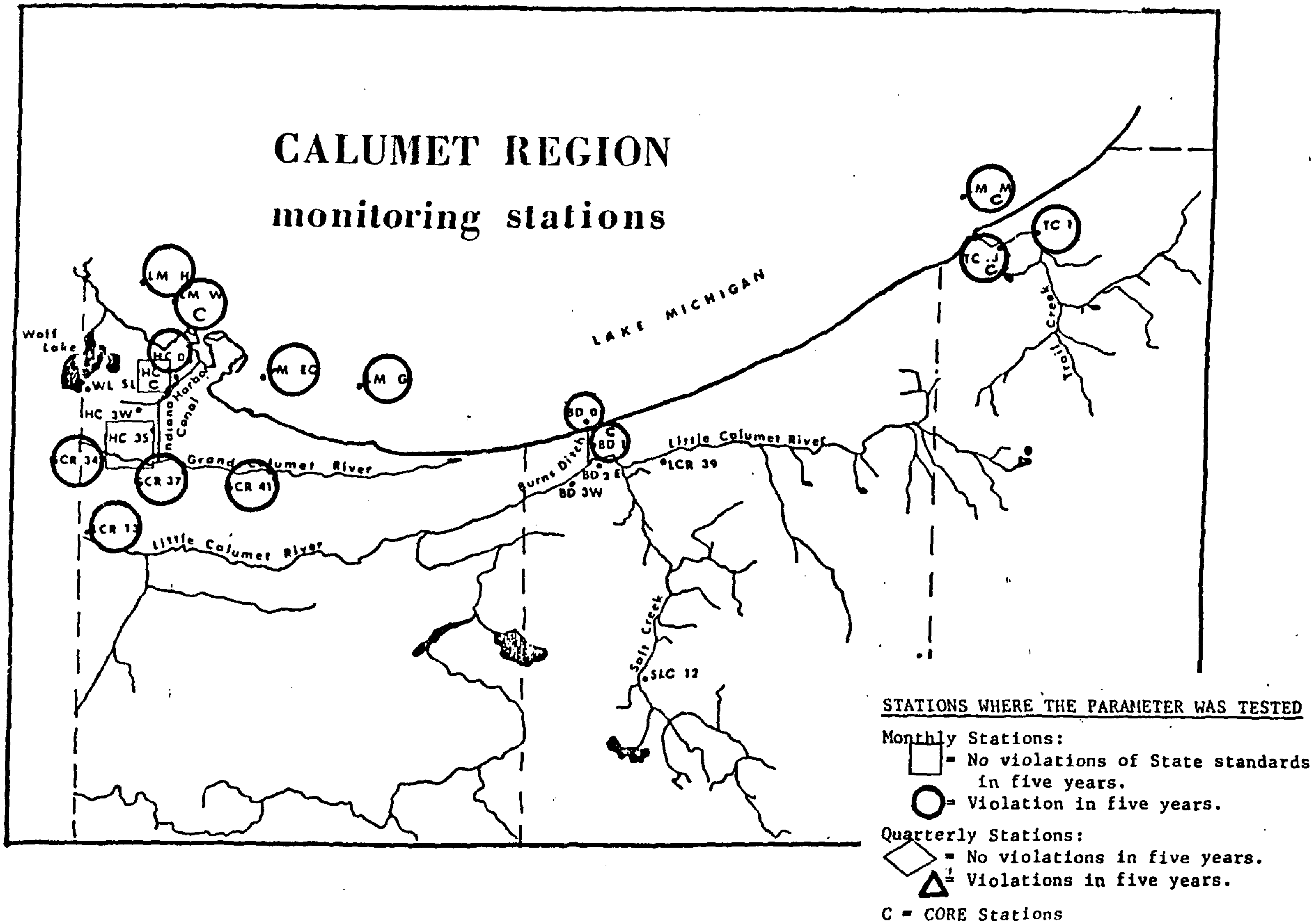


Figure 23. IDEM water quality monitoring report - mercury (Source 22)

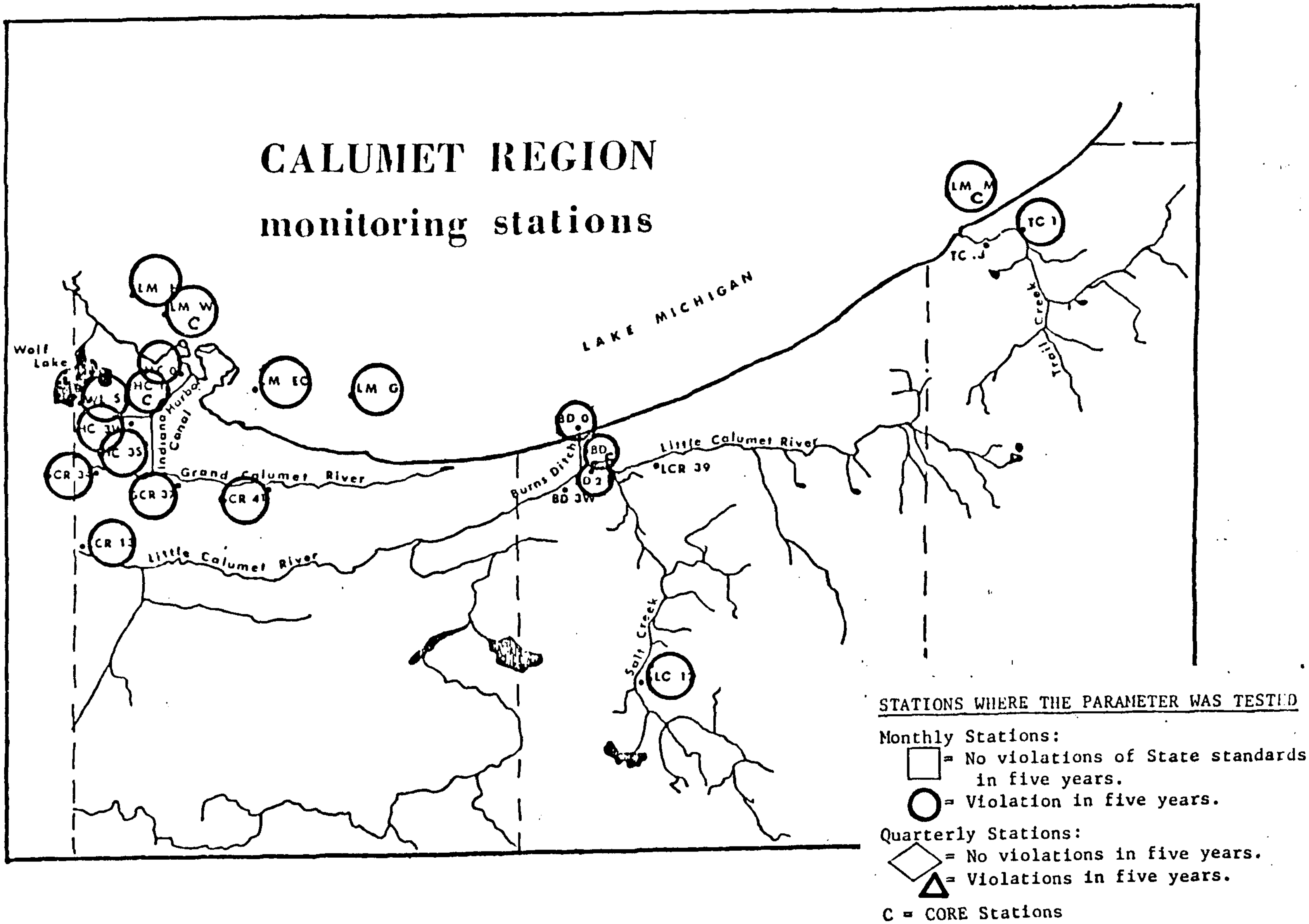


Figure 24. IDEM water quality monitoring report - oil and grease (Source 22)

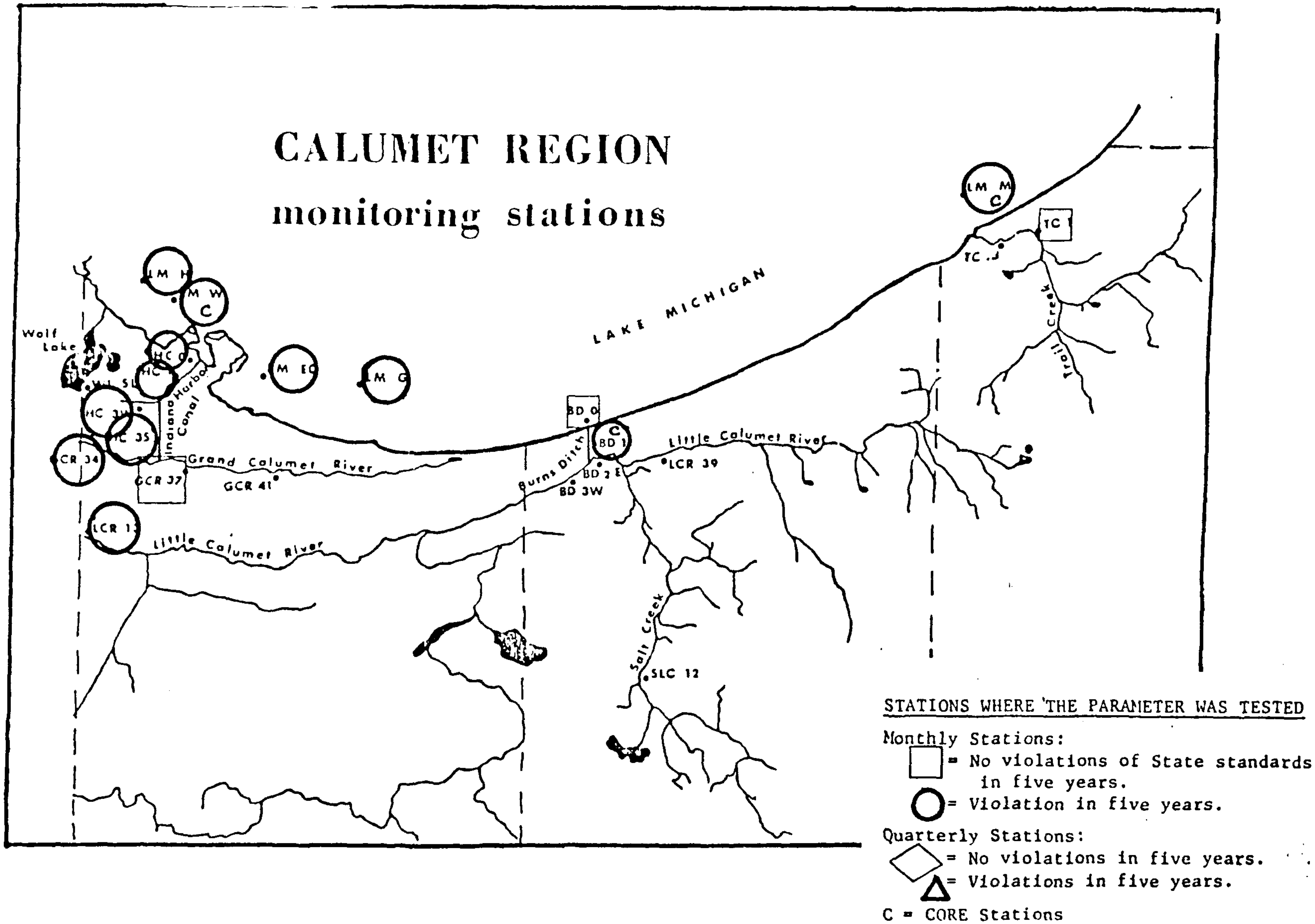


Figure 25. IDEM water quality monitoring report - phenol (Source 22)

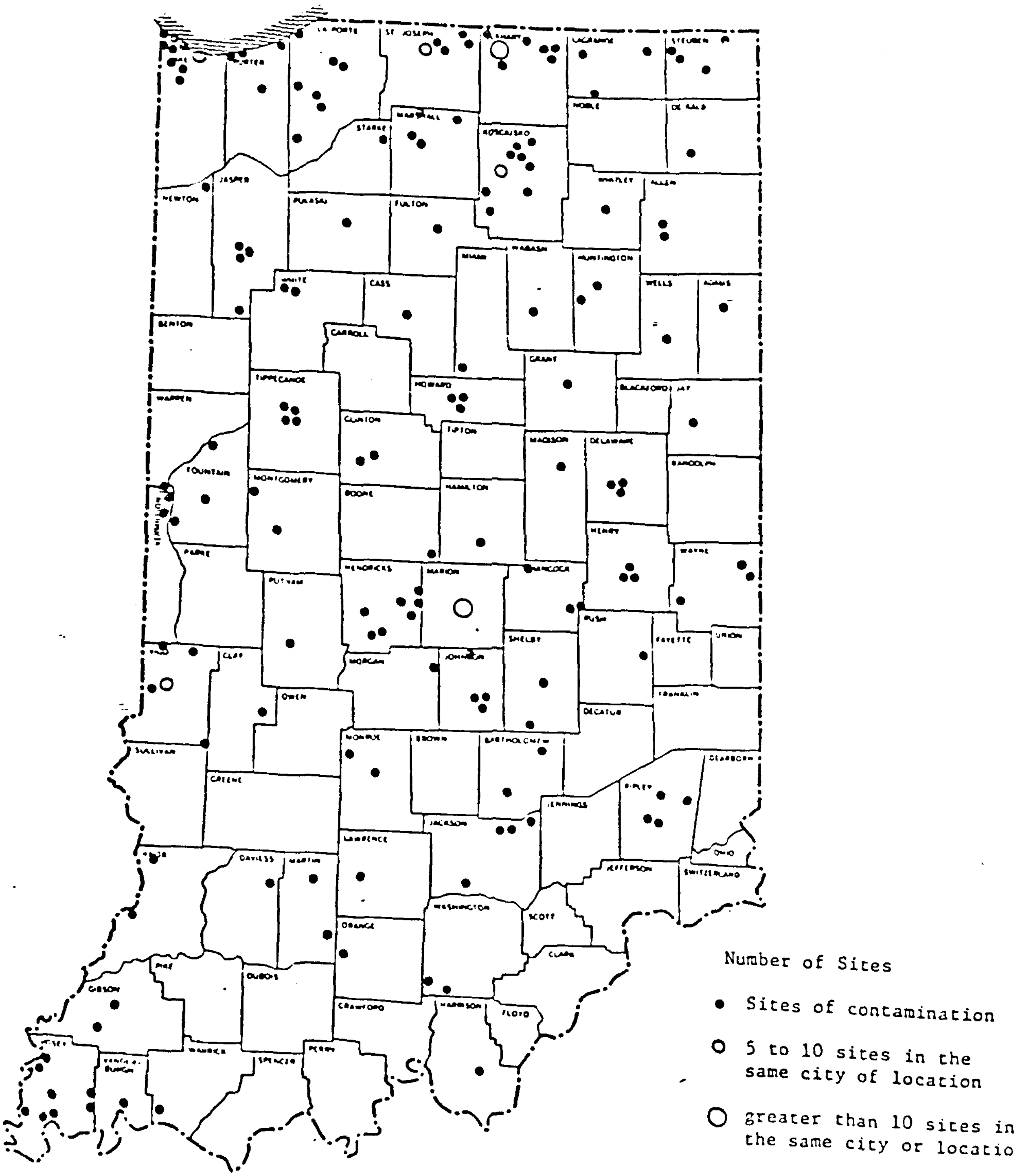


Figure 26. Sites of documented groundwater contamination
(Source R11, Figure 22)

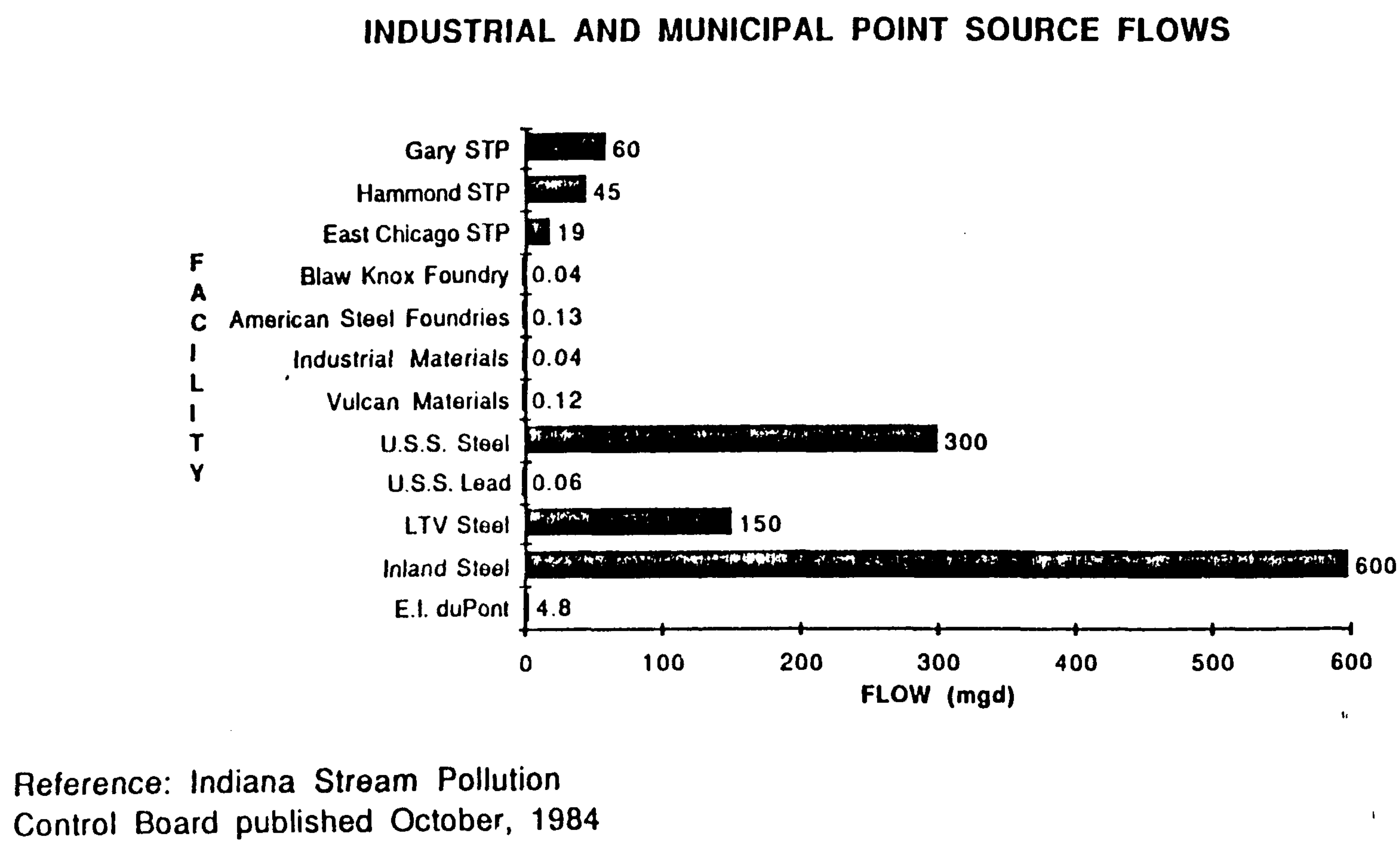


Figure 27. Summary of municipal and industrial point source flows
(Source R14, Figure 2)

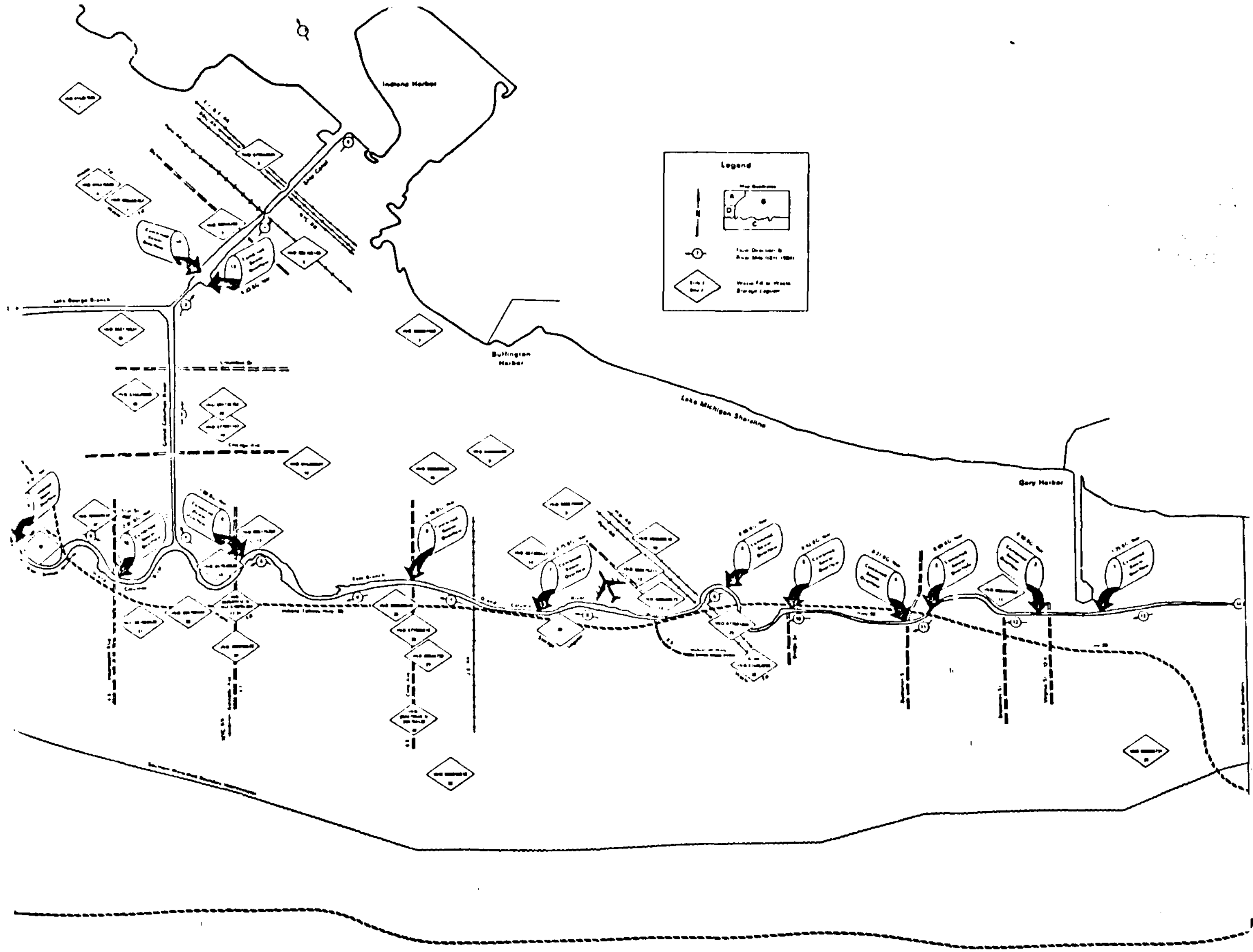


Figure 28. Locations of combined sewer outflows and waste fills in the AOC (Source R13, Figure 2-6) (see Tables 36 and 37)

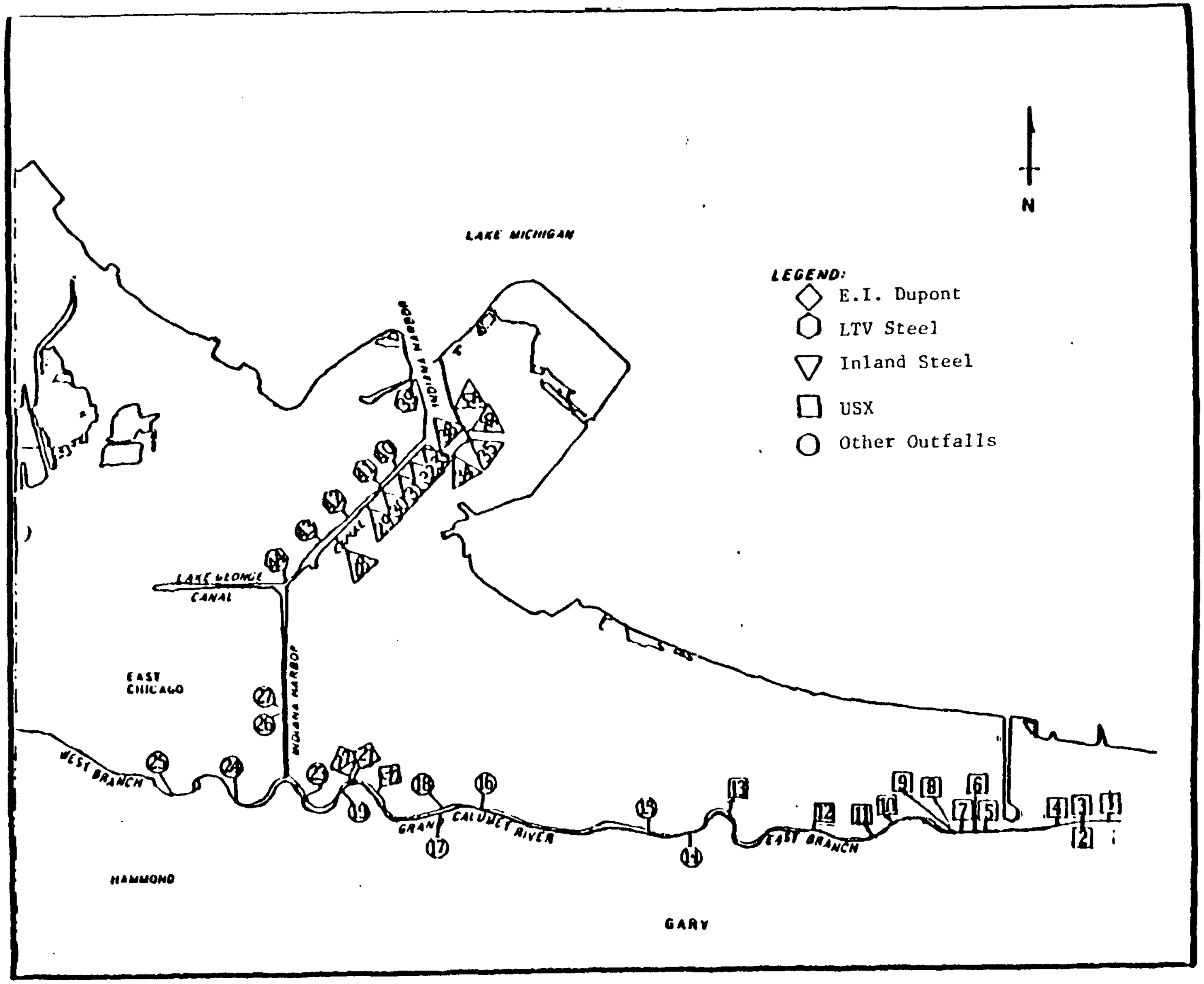


Figure 29. Locations of point source dischargers in the AOC (Source R20, Figure 1) (legend on following page; see also Tables 39-42) (Continued)

LEGEND FOR FIGURE 29

Map #	Source	Type of Discharge	Flow (MGD)
1.	U.S. Steel	P/C	60
2.		C	2
3.		P/C	14
4.		P	5
5.		C	1
6.		C	55
7.		C	70
8.		P/C	90
9.		P	35
10.		P/C	90
11.		C	7
12.		C	3
13.		P/C	14
14.	Gary STP	P	60
15.	Industrial Disposal		M.D.
16.	Vulcan Materials	P/C	N.A.
17.	Explorer Pipe		M.D.
18.	Citgo Petroleum	C	M.D.
19.	Harbison-Walker		M.D.
20.	Dupont	C	5
21.		P	5
22.		P	5
23.	U.S.S. Lead	P	.06
24.	E. Chicago STP	P	20
25.	Hammond STP	P	48
26.	Blaw-Knox	P	2.2 tgd
27.		P	2.2 tgd
28.	Inland Steel	P/C	1
29.		P/C	135
30.		P/C	8
31.		P/C	13
32.		P/C	30
33.		C	45
34.		C	90
35.		P/C	18
36.		P	42
37.		P/C	30
38.		P/C	130
39.	J&L Steel	P	57
40.		C	46
41.		C	43
42.		C	2
43.	American Steel	C	.22
44.	J&L Steel	P	9

Notes

P= Process wastewater, treated process wastewaters, and/or contact cooling waters

C= Non-contact cooling waters, and/or stormwater runoff

P/C=Outfall discharges both types of waters

M.D.= Minor discharge

MGD= Million gallons per day

tgd= thousand gallons per day

Figure 29 (Concluded)

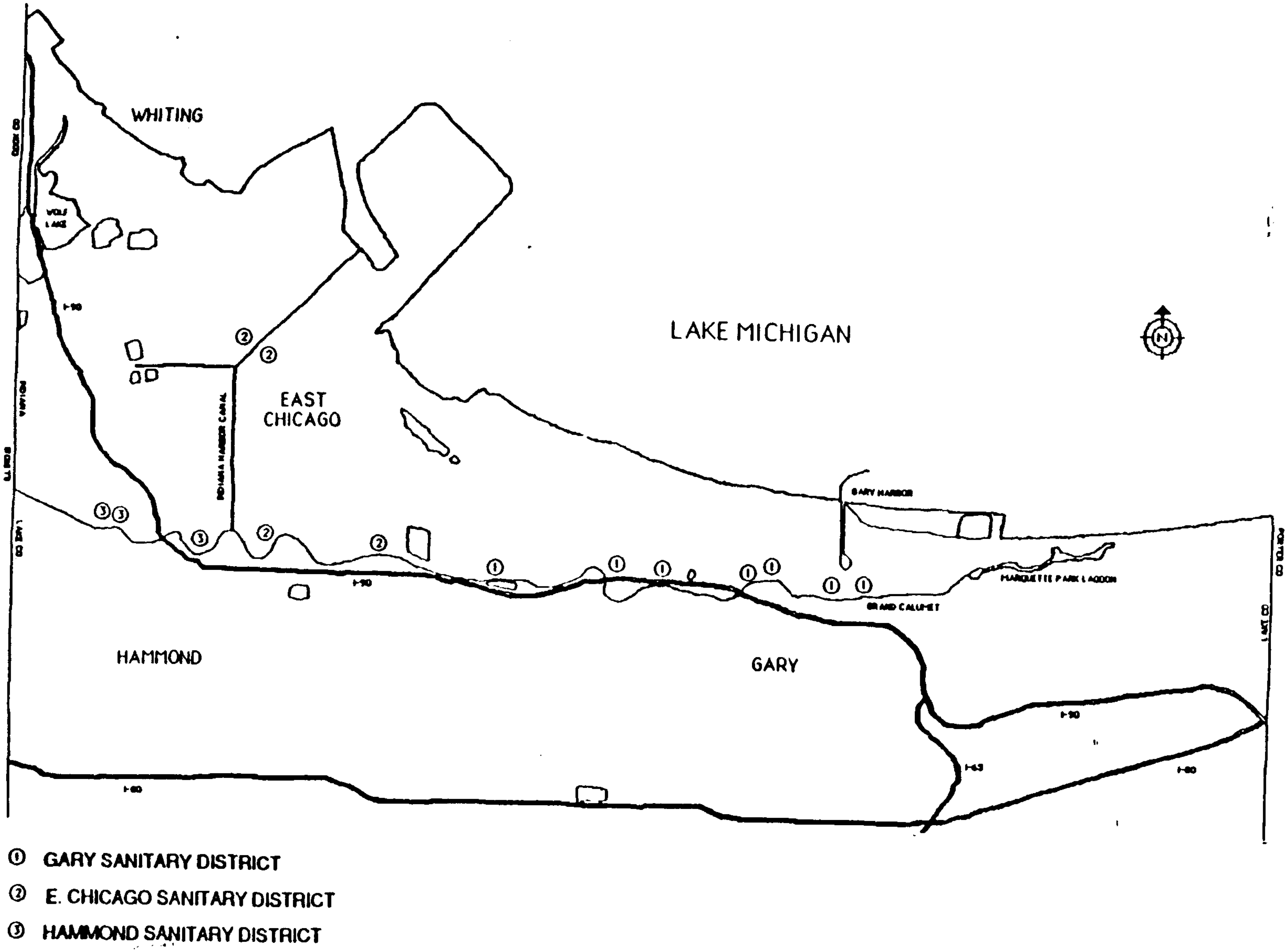


Figure 30. Locations of combined sewer overflow discharges to AOC
(Source R14, Figure 3)

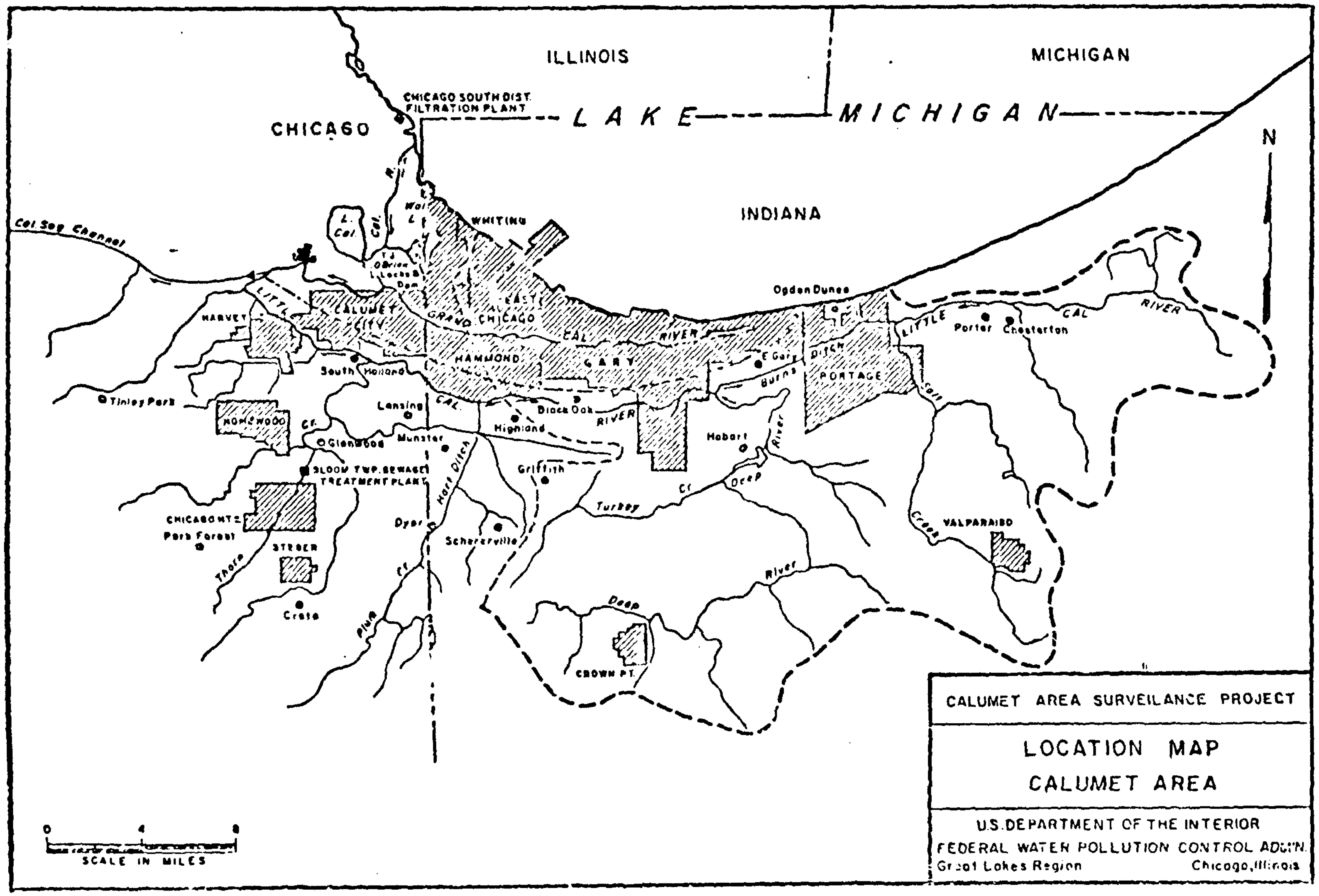


Figure 31. Drainage basin of Calumet area tributary streams (Source R18, Figure 2.2) (see Table 50)

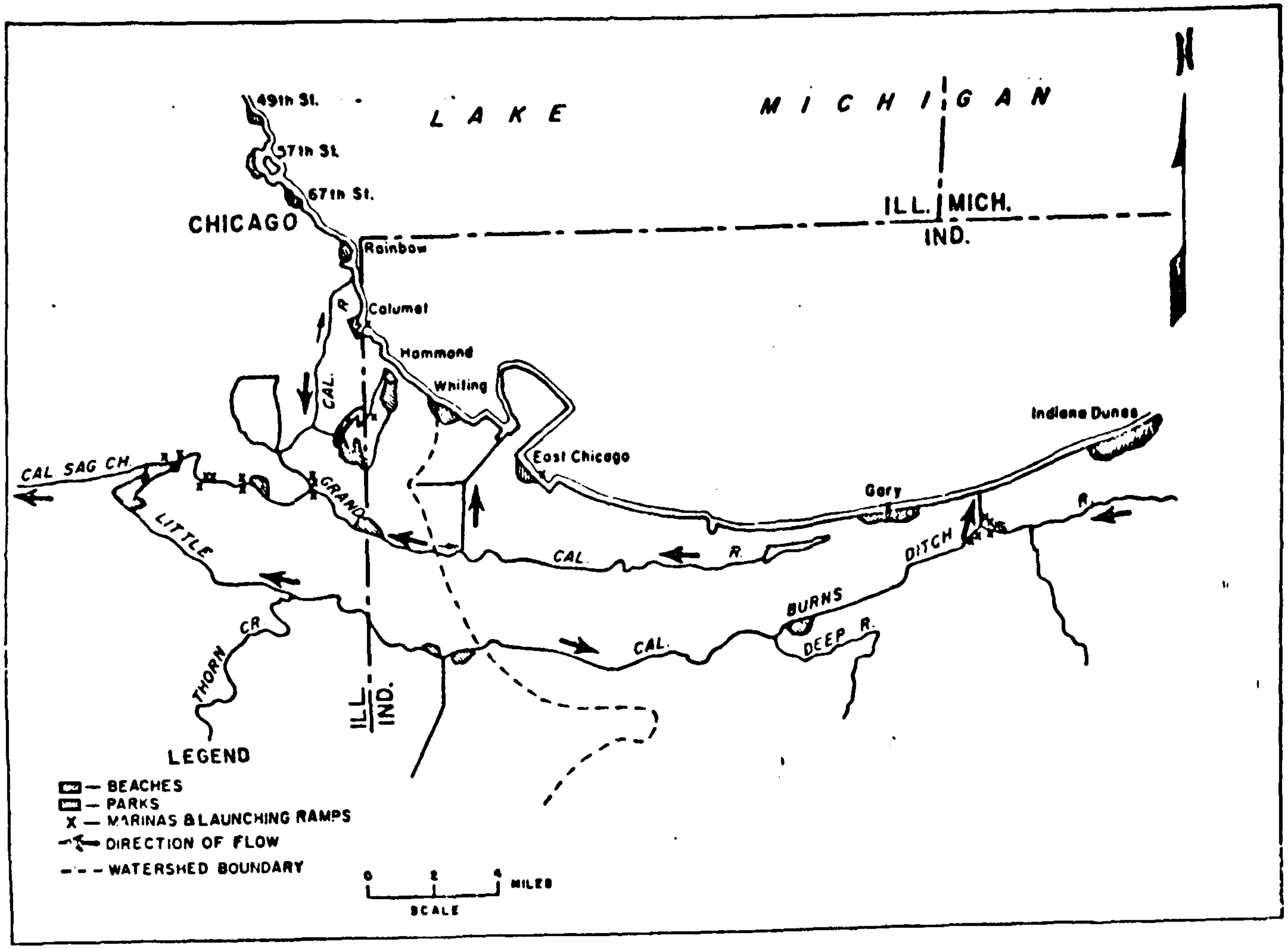


Figure 32. Streamflow directions within the AOC (Source R18, Figure 2.1)
(see Tables 50 and 51)

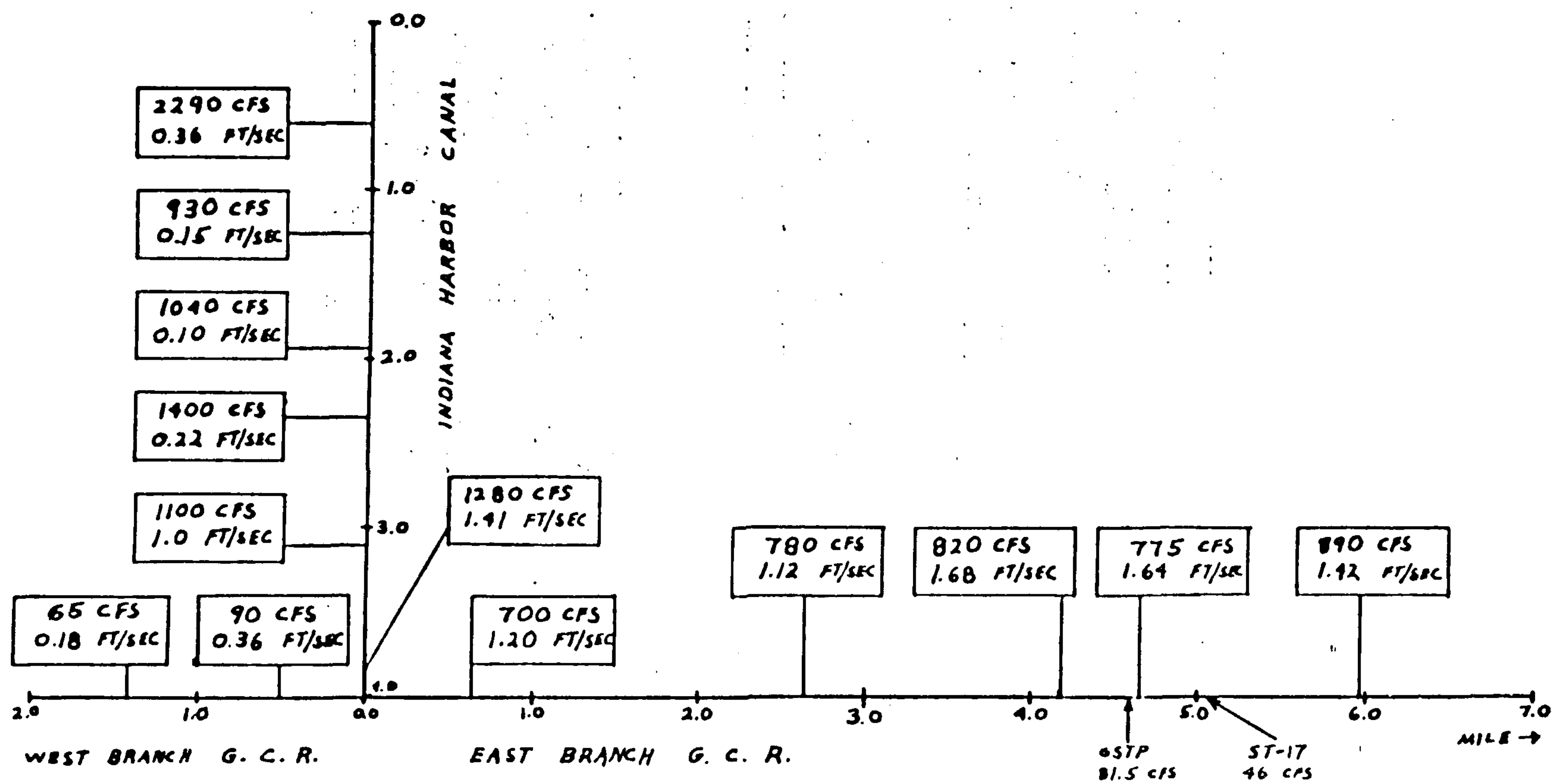


Figure 33. Flow survey of GCR-IHC (Source R18, Figure 3.2)
(see also Figure 32 and Tables 50 and 51)

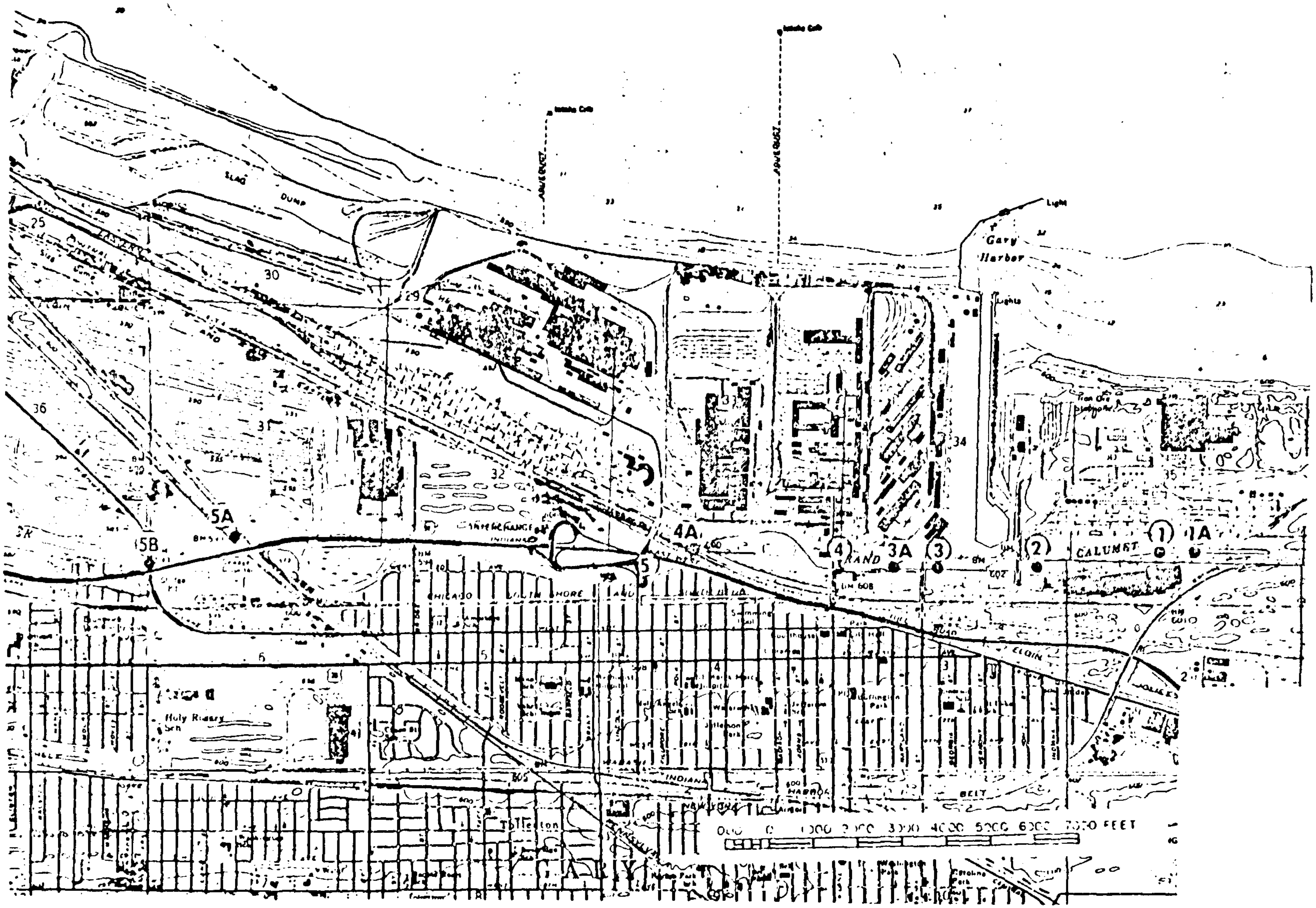
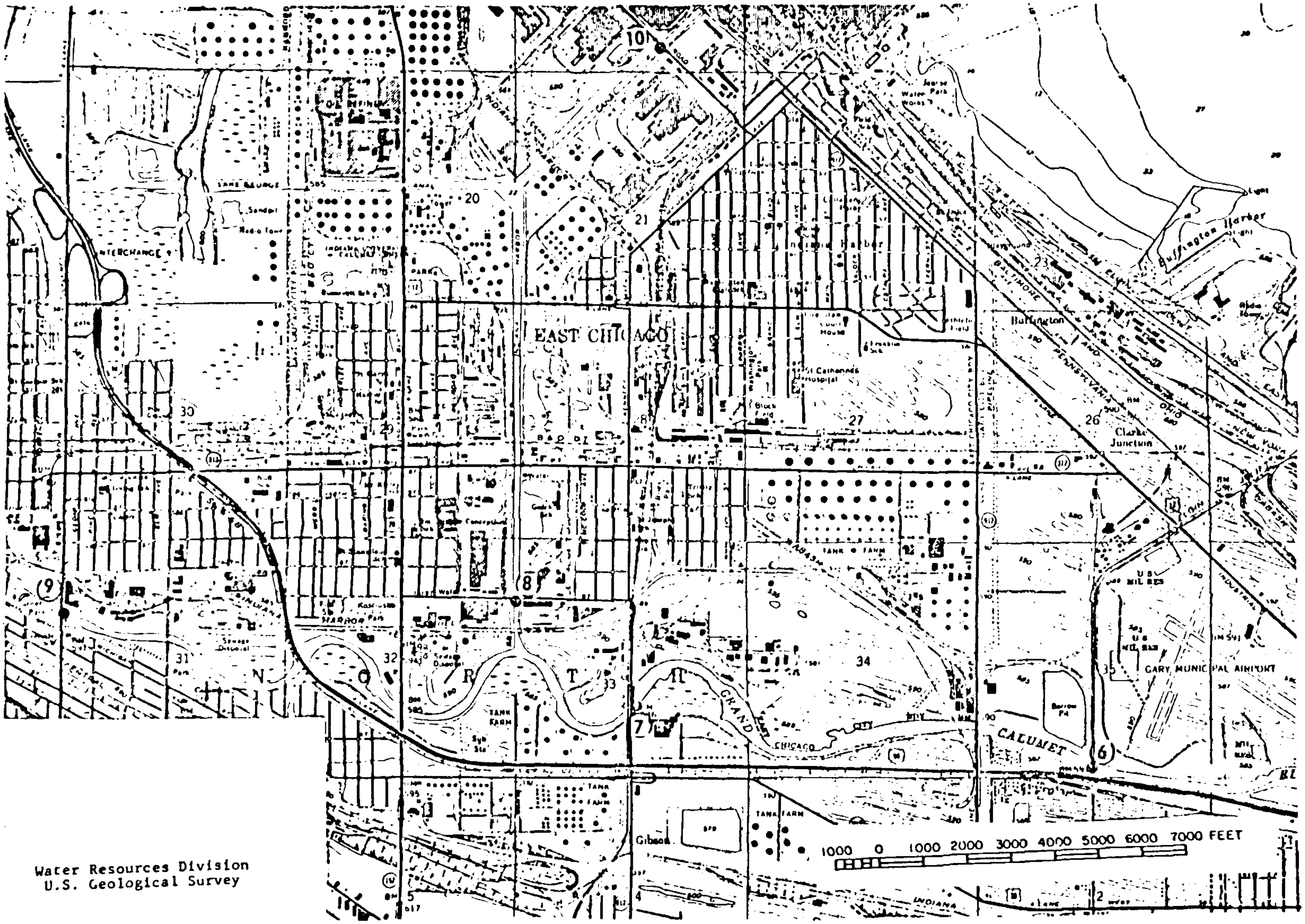


Figure 34a. Location of sites of the USGS Grand Calumet River inflow investigation (Source R18, 3.1a) (see Tables 50-54)



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U.S. Geological Survey

Figure 34b. Location of sites of the USGS Grand Calumet River inflow investigation (Source R18, 3.1b) (see Tables 50-54)

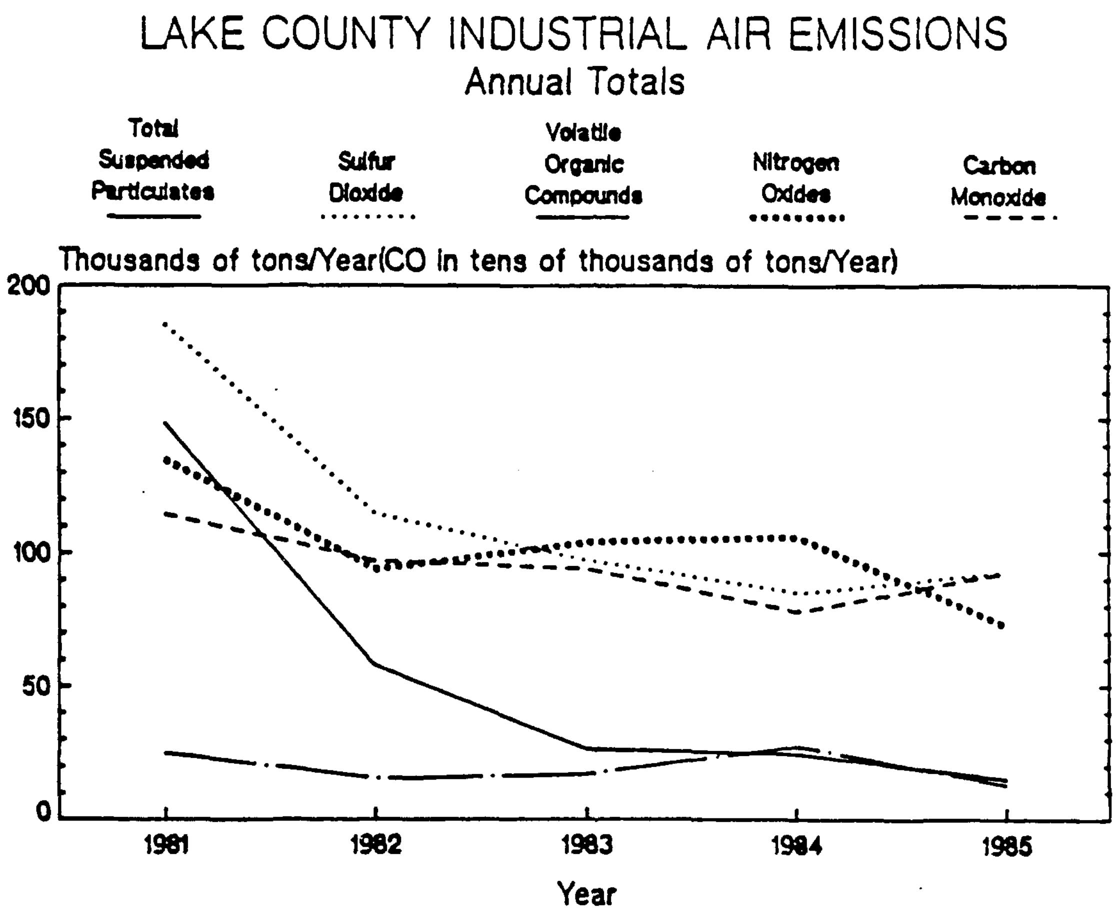


Figure 35. Summary of total air pollution emissions for AOC (Source R14, Figure 4)

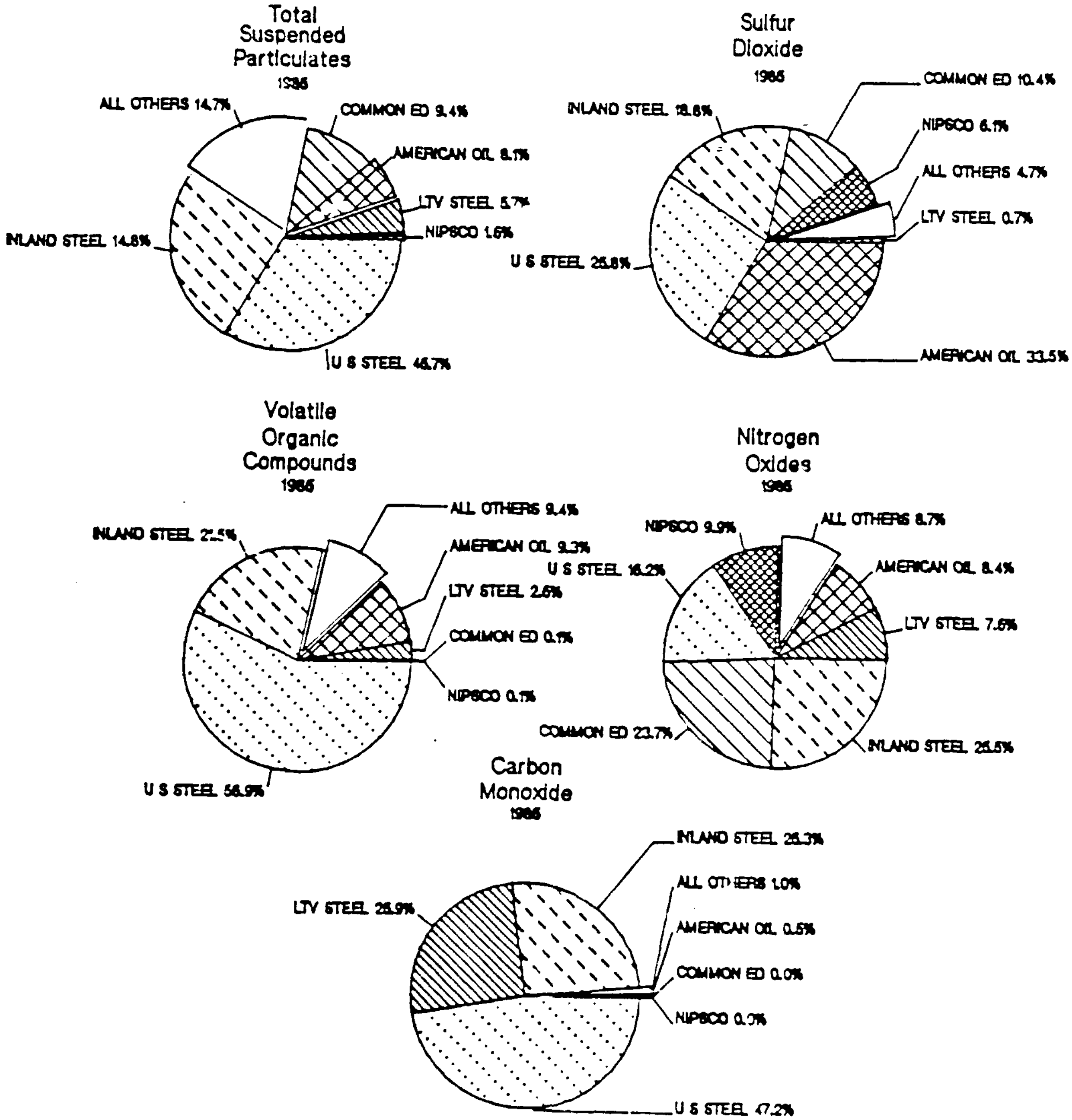


Figure 36. Major sources of air pollution (Source R14, Figure 5)

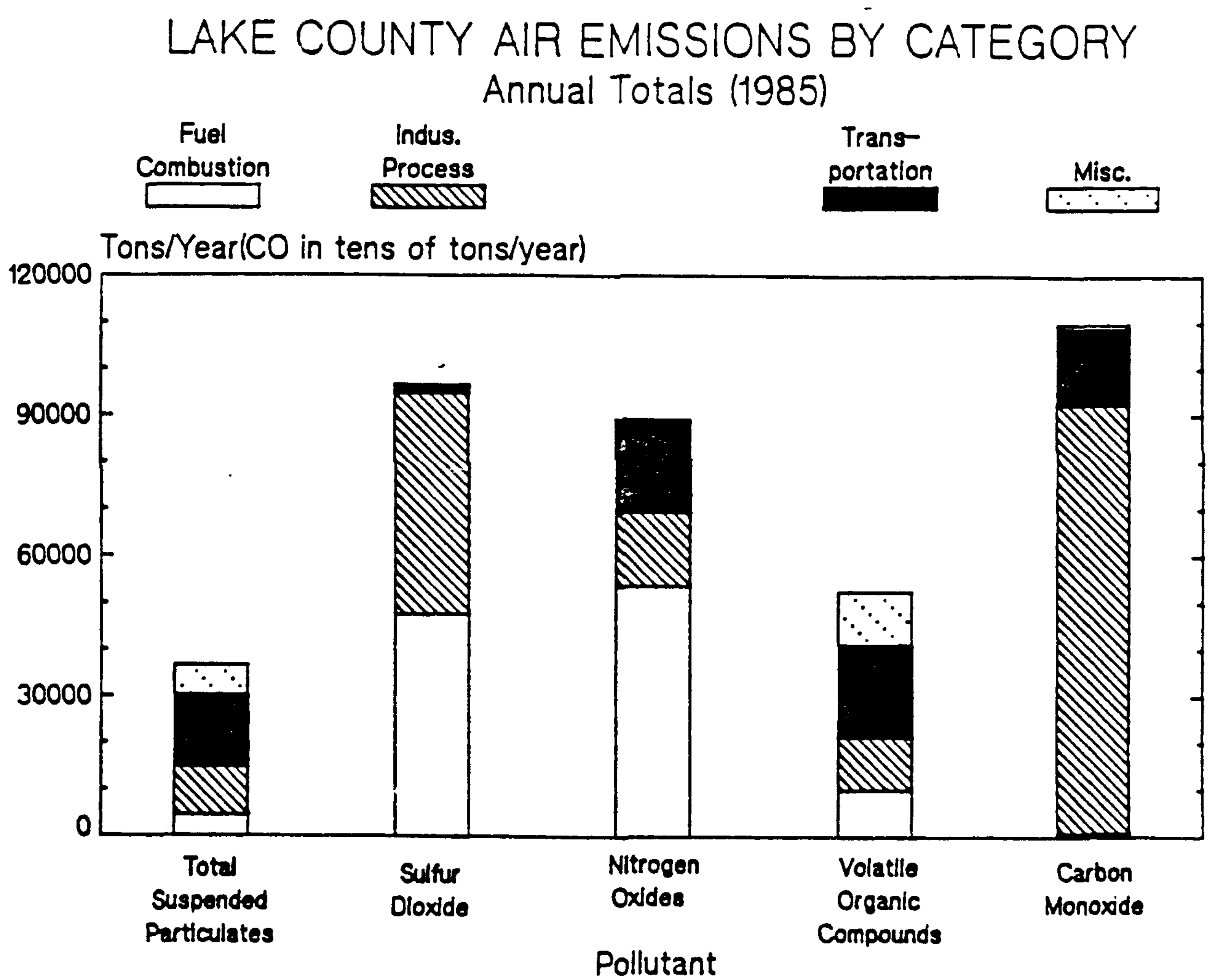


Figure 37. Major sources of air pollution by category (Source R14, Figure 6)

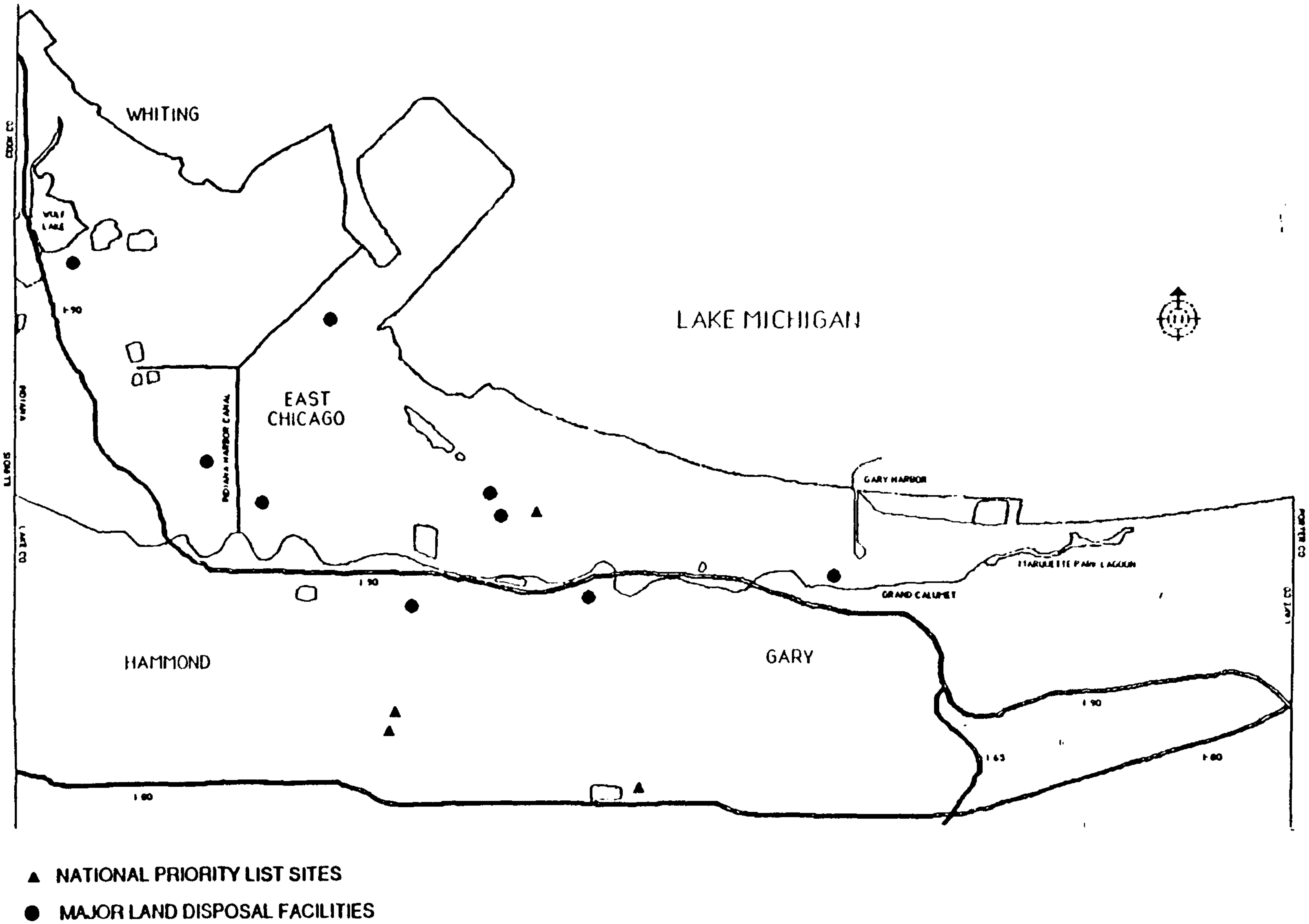
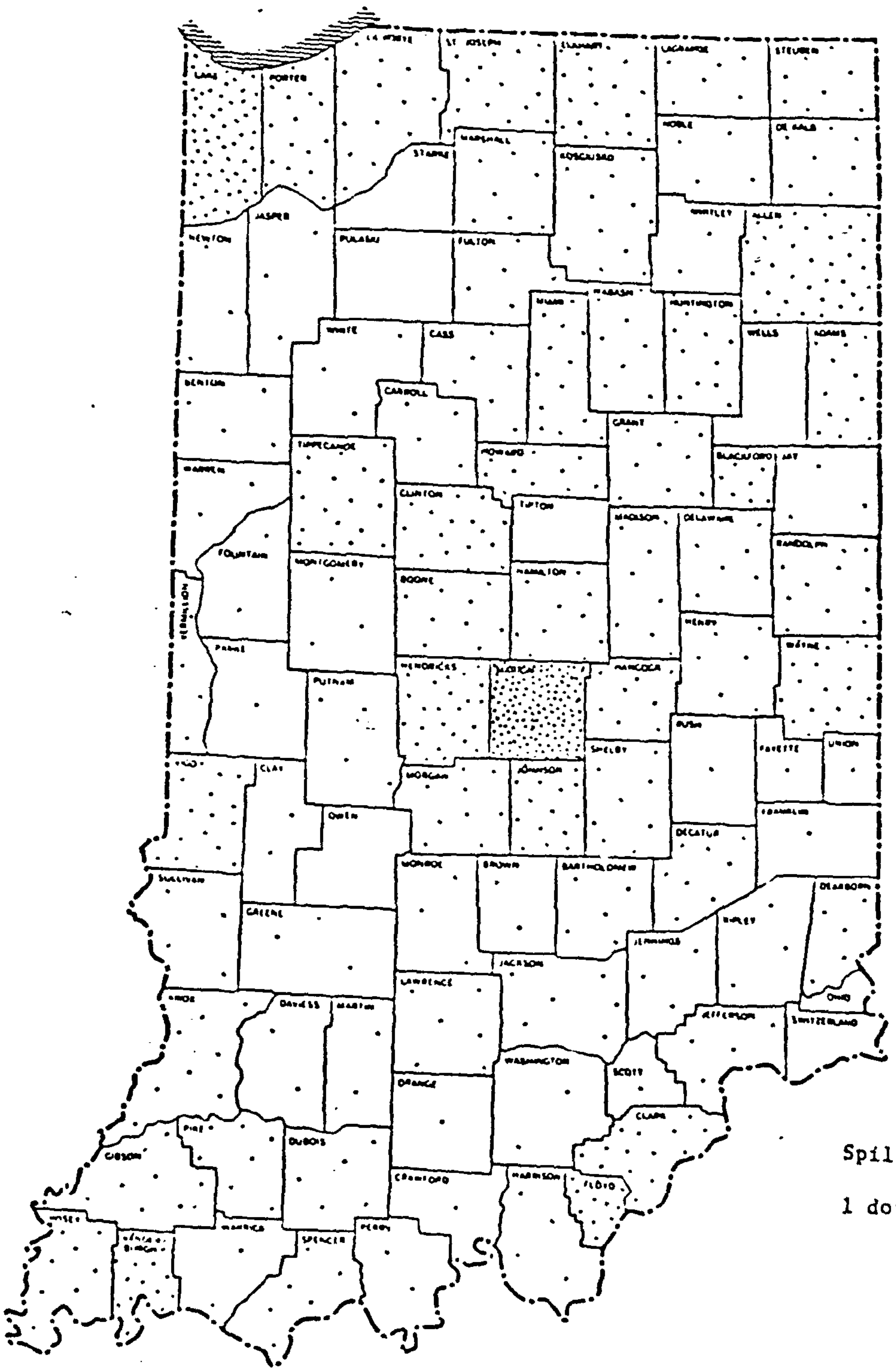


Figure 38. Locations of major landfills in the AOC (Source R14, Figure 7)



Spills Per County

1 dot = 1 reported spill

Figure 39. Reported spills of hazardous materials (Source R11, Figure 28)

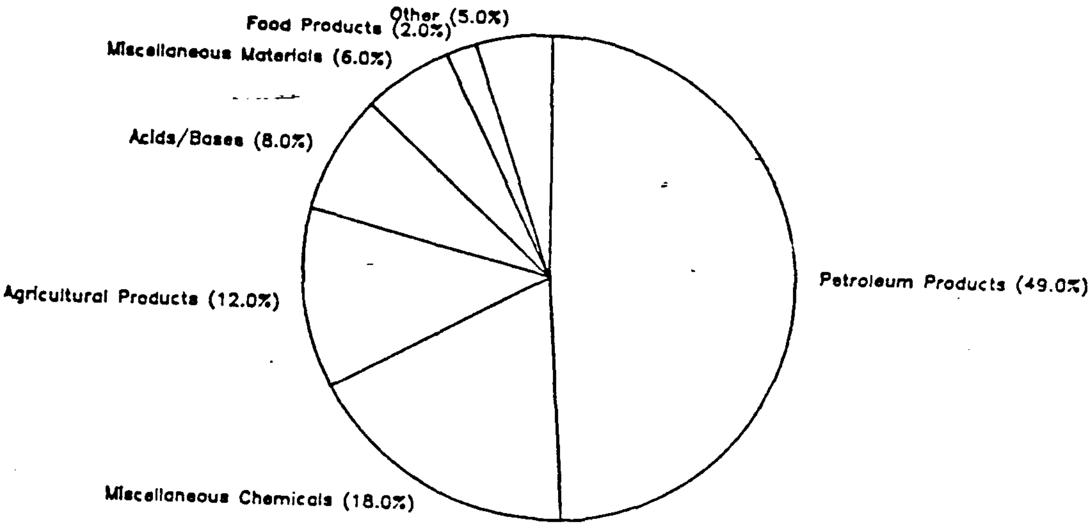


Figure 40. Types of materials spilled (Source R11, Figure 29)

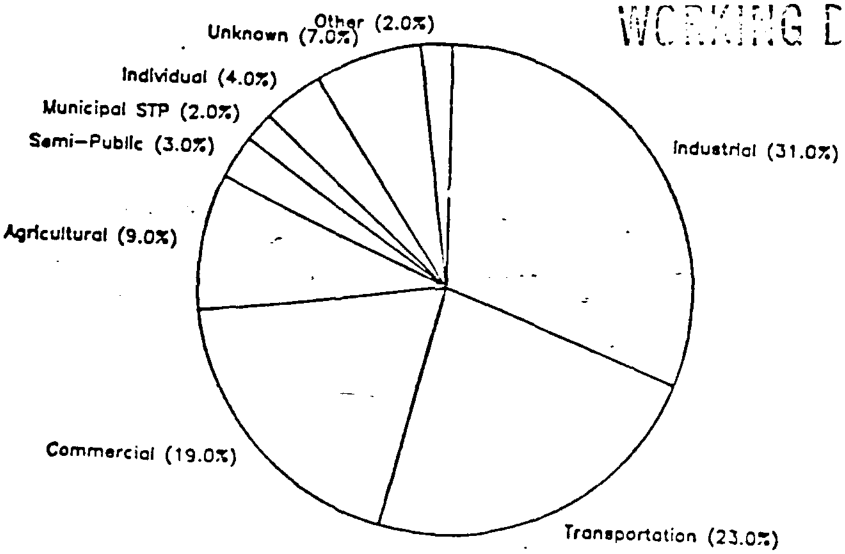


Figure 41. Sources of materials spilled (Source R11, Figure 30)

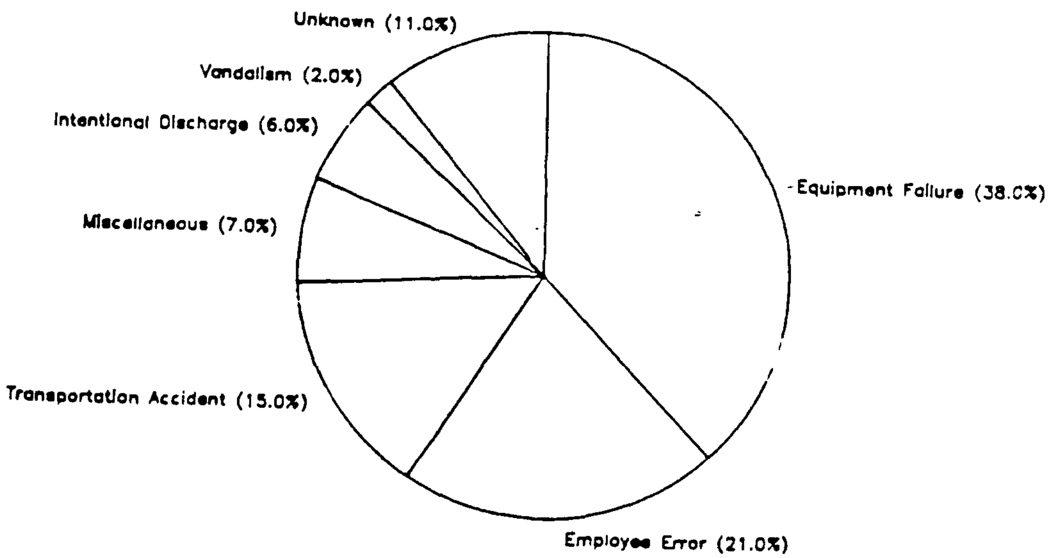


Figure 42. Circumstances of materials spilled (Source R11, Figure 31)

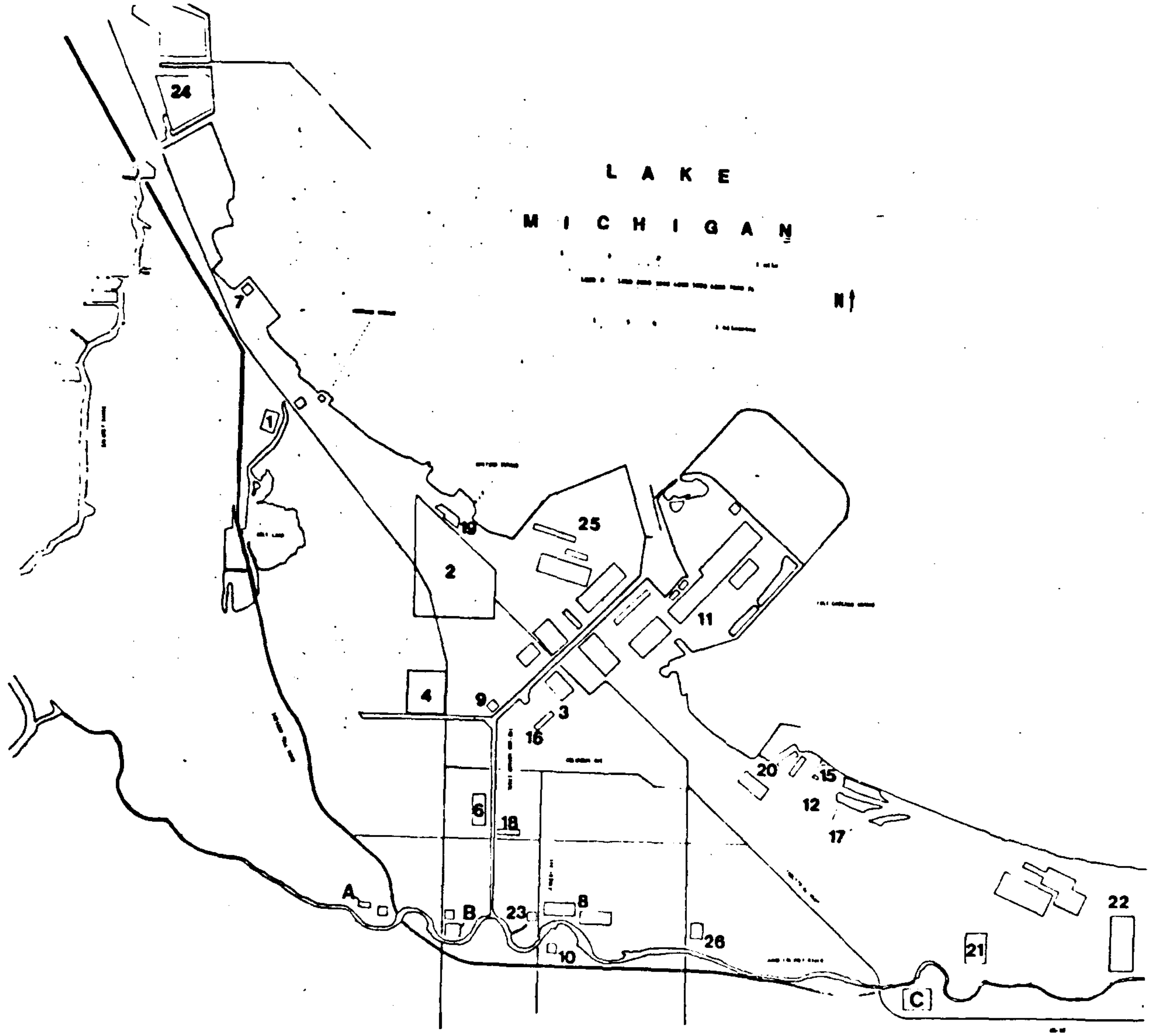


Figure 43. Locations of major industrial and municipal plants (Source R18, Figure 4-18) (Continued)

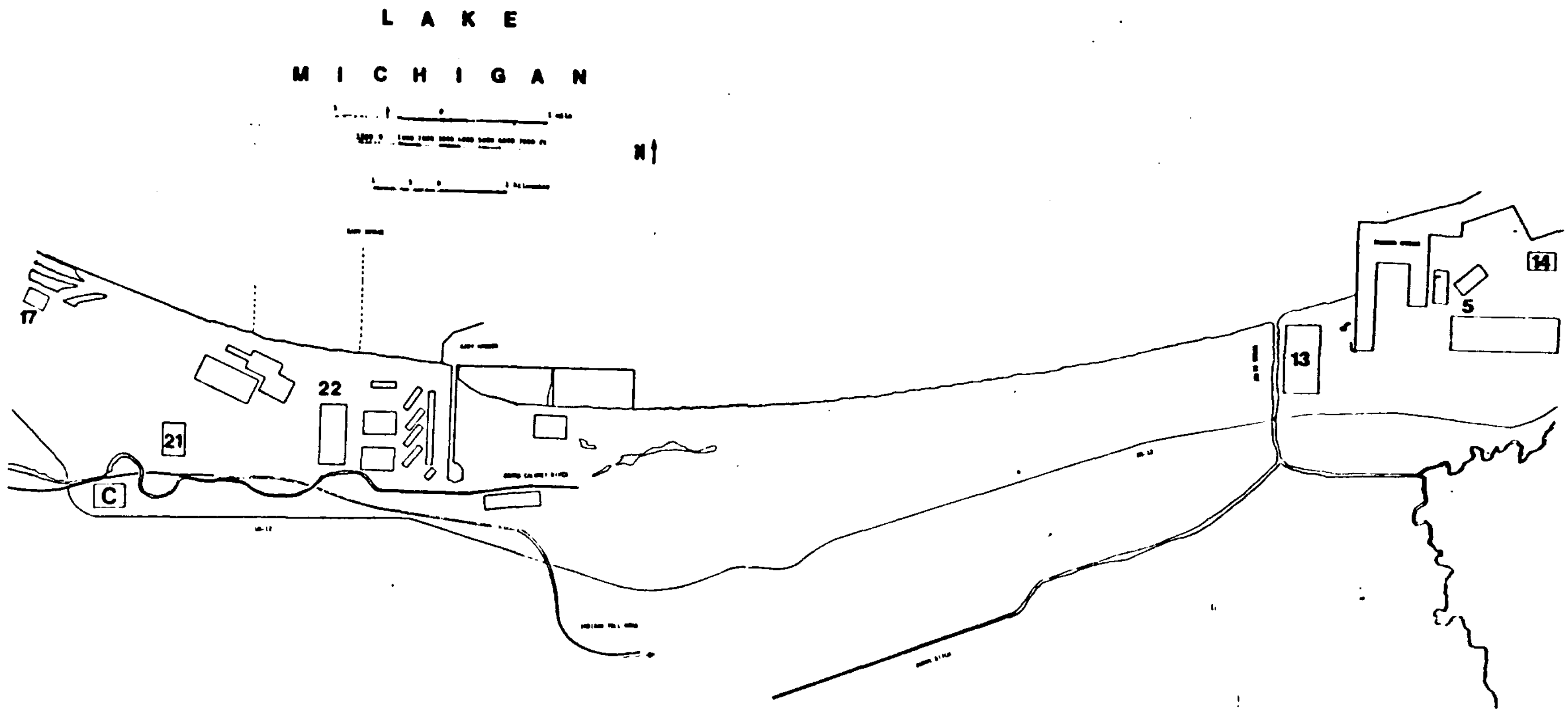


Figure 43. (Concluded)

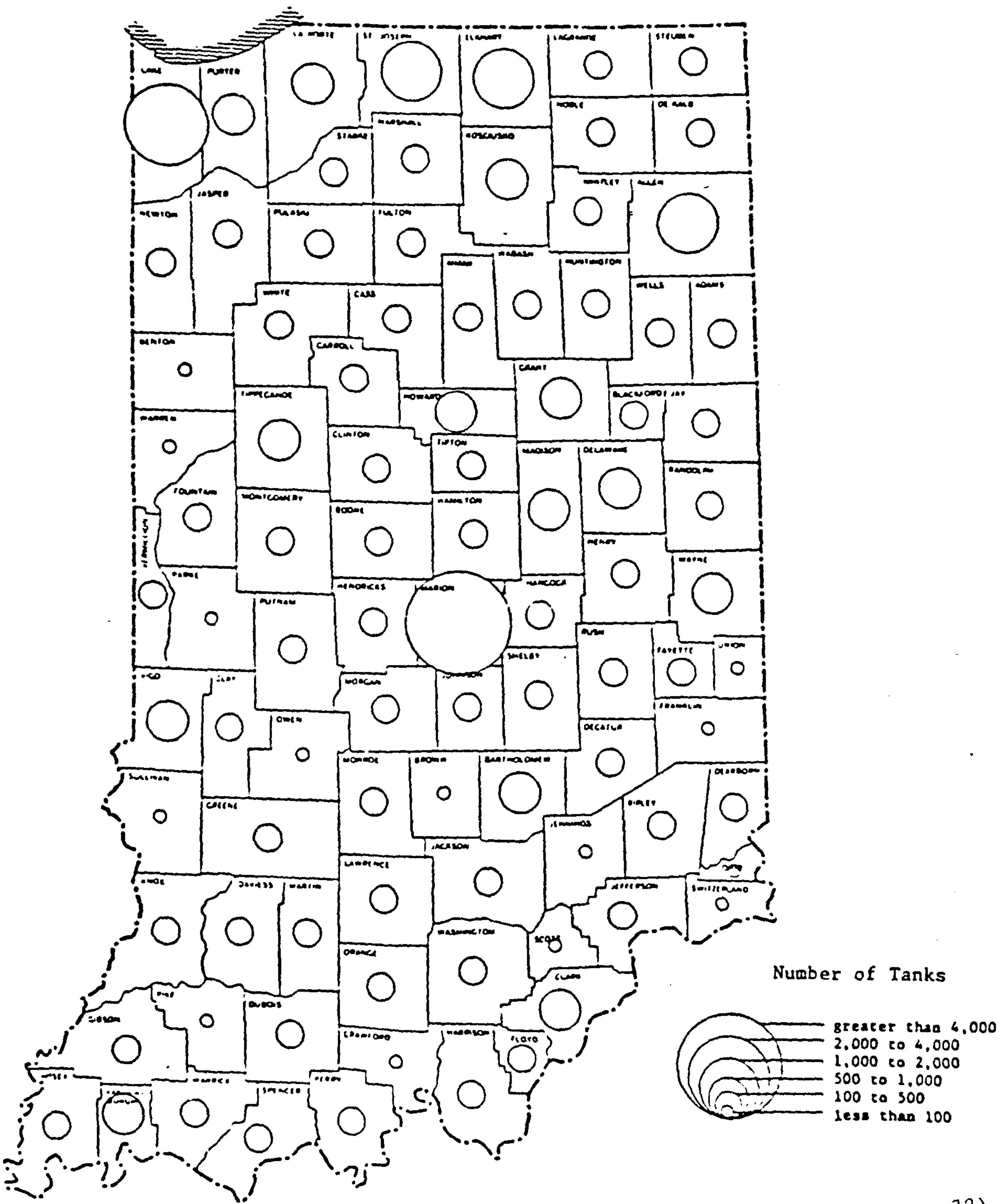


Figure 44. Numbers of underground storage tanks (Source R11, Figure 32)

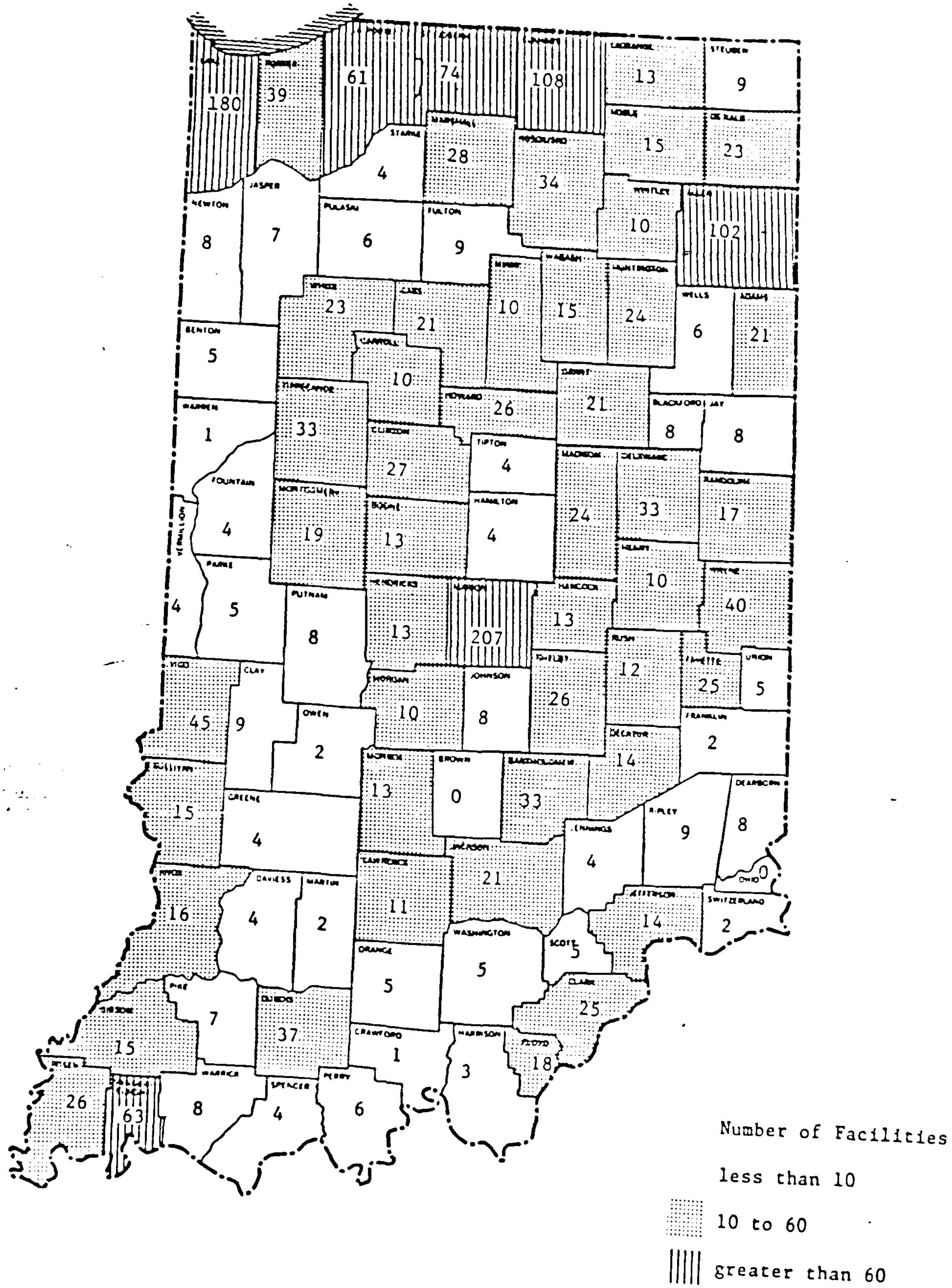


Figure 45. Numbers of hazardous waste facilities (Source R11, Figure 37)

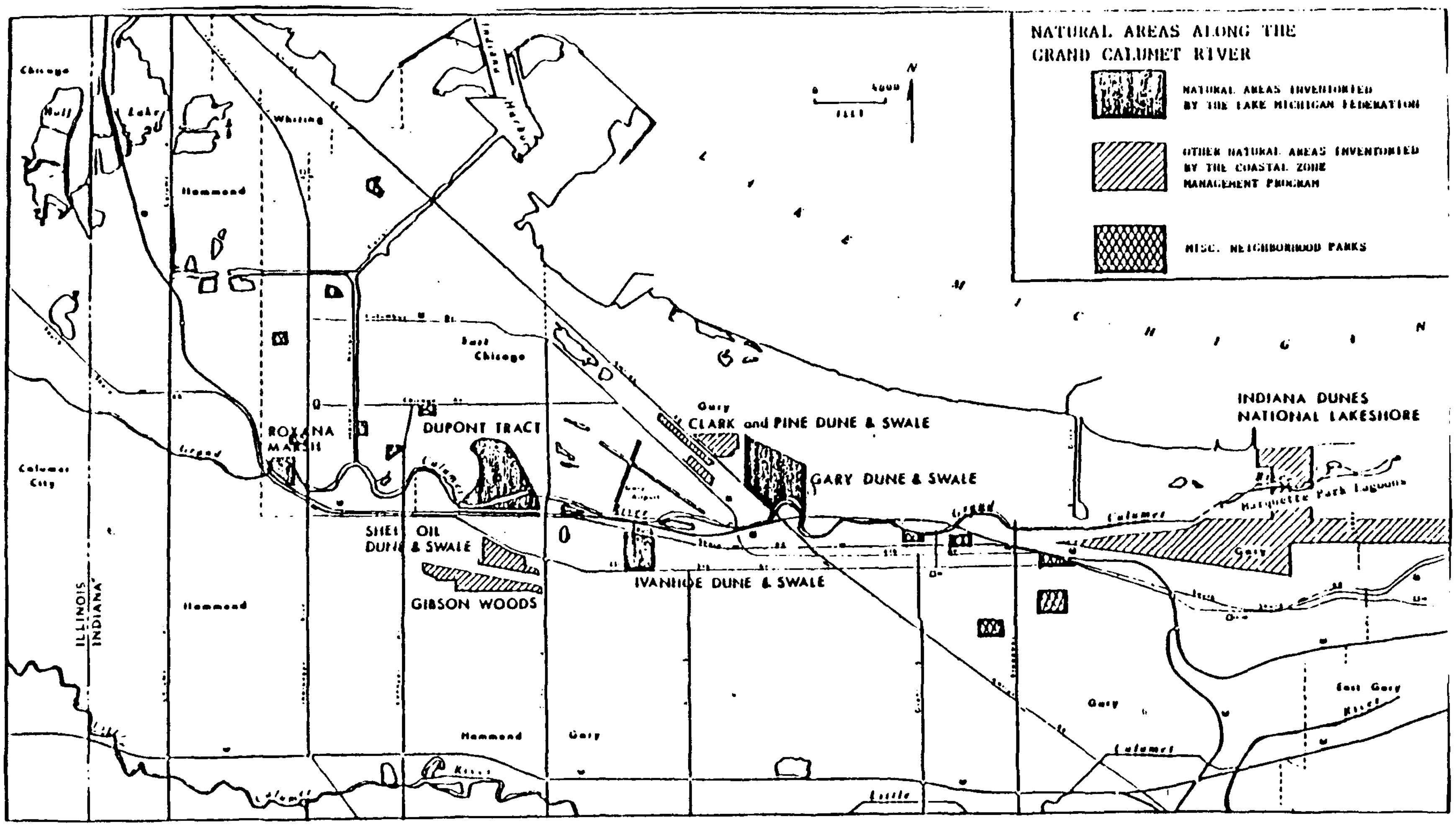


Figure 46. Natural areas along the GCR-IHC (Source R13, Figure 4-3)

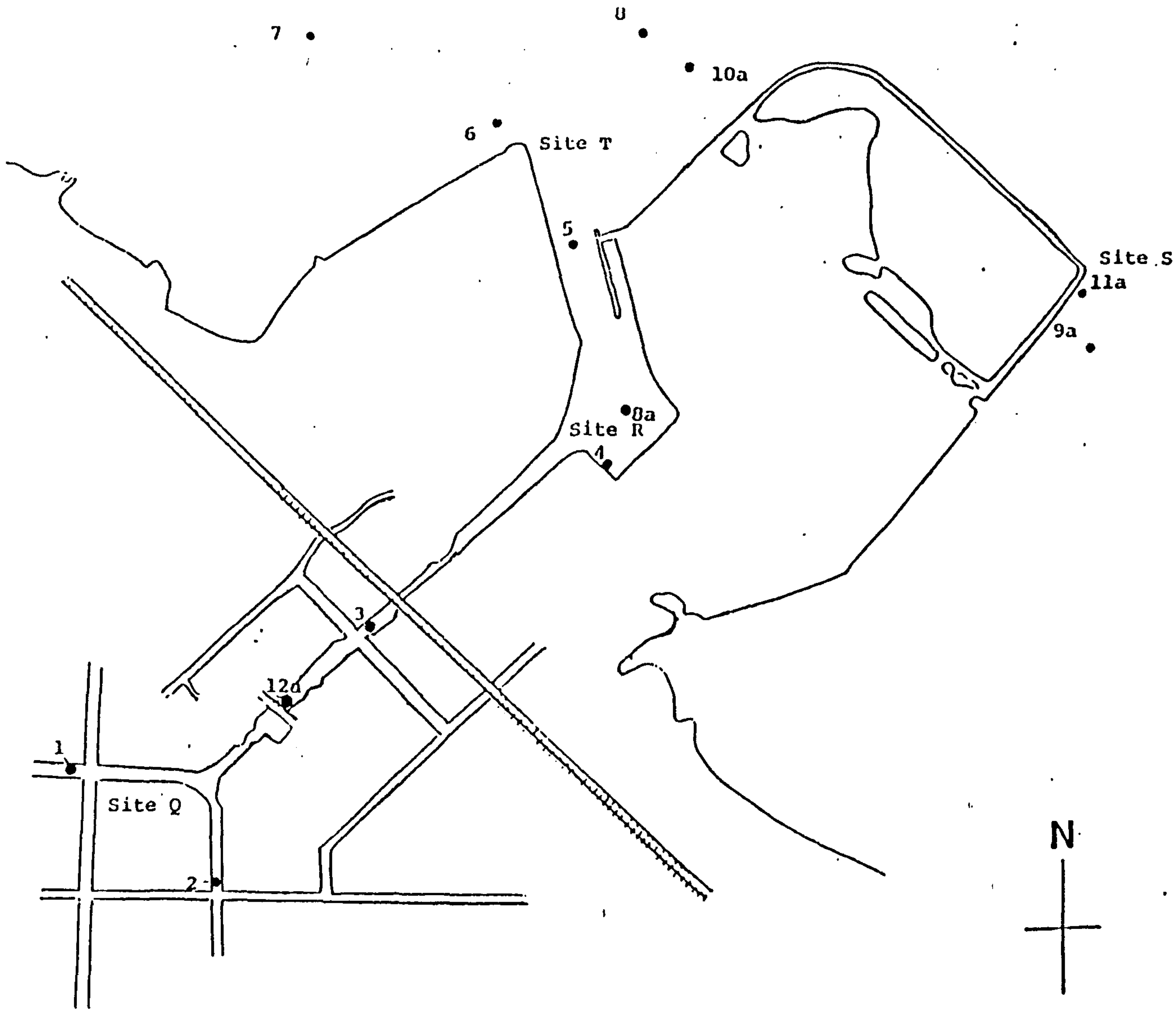


Figure 47. Locations of benthos sampling stations in Indiana Harbor (a = alternate station substituted for original due to rough water) (Source R1, Figure 1)

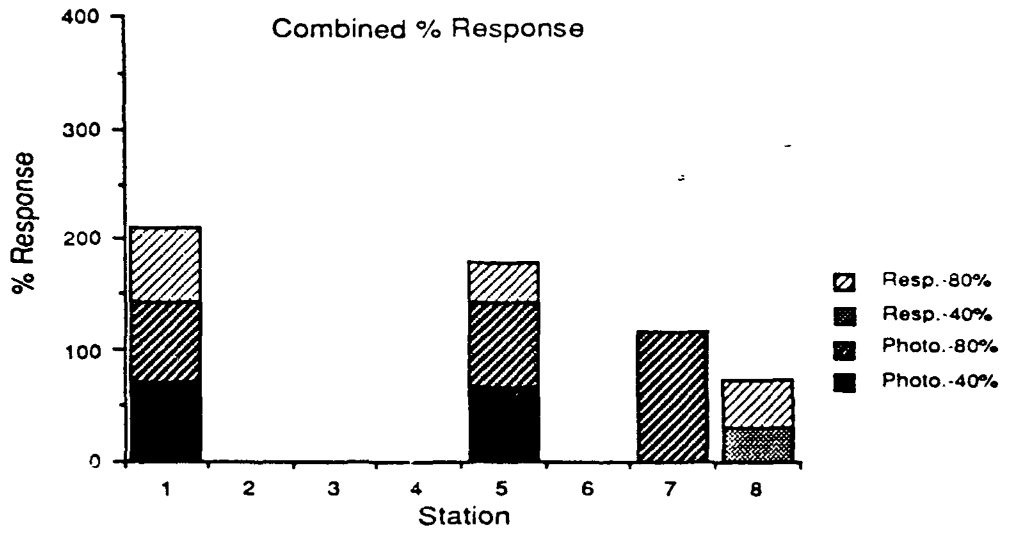


Figure 48. Cumulative [significant] percent response for eight protozoan community field bioassays [Station 2 was not included] (Source R1, Figure 7a) (see Figure 47)

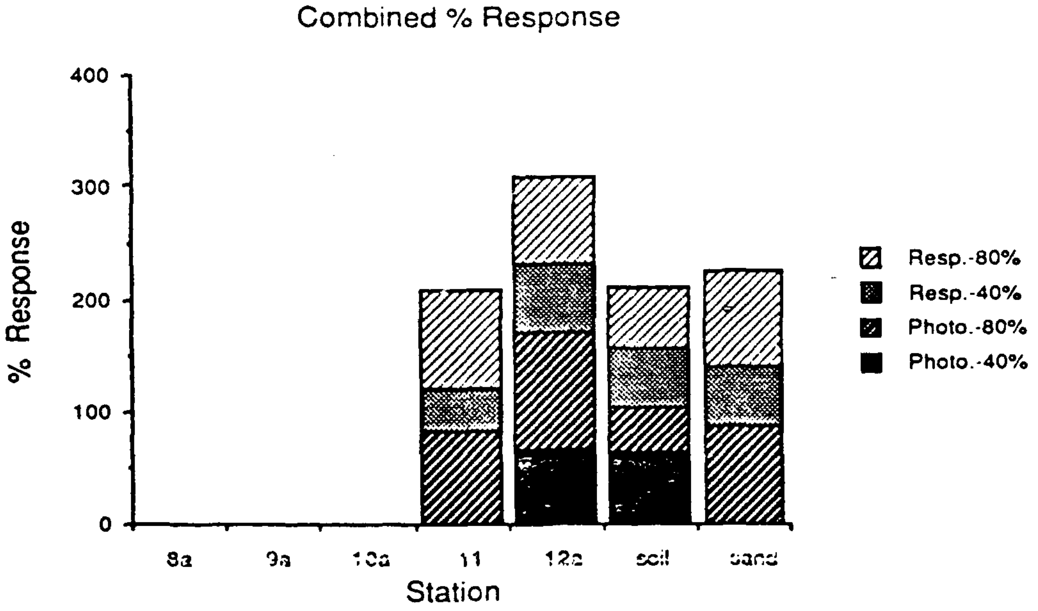


Figure 49. Cumulative [significant] percent response for seven protozoan community bioassays [stations 8a-12a, soil, and sand] (Source R1, Figure 7b) (see Figure 47)